

MASON COUNTY PUD NO. 1

MASON COUNTY

WASHINGTON



CONTRACT PROVISIONS

for

VUECREST RESERVOIR AND BOOSTER STATION

G&O #21568
SEPTEMBER 2023



Gray & Osborne, Inc.
CONSULTING ENGINEERS

MASON COUNTY PUD NO. 1

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VUECREST RESERVOIR AND BOOSTER STATION



9/23/03

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PUBLIC NOTICE
INVITATION FOR BIDS
VUECREST RESERVOIR AND BOOSTER STATION
ENGINEER'S ESTIMATE \$980,000

NOTICE IS HEREBY GIVEN THAT PUBLIC UTILITY DISTRICT No. 1 OF MASON COUNTY, WA, does hereby invite bids from qualified, responsible bidders for Vuecrest Reservoir and Booster Station.

SUBMISSION DEADLINE:

SEALED proposals must be received at the Mason County PUD No. 1 main office located at 21971 North Highway 101, Shelton, WA 98584, by **4:00 p.m. PST on Monday, March 4, 2024**, be addressed to "Brandy Milroy-Vuecrest Reservoir and Booster Station" and include amounts for furnishing the necessary labor, materials, equipment, and tools, thereof to construct the Vuecrest Reservoir and Booster Station. Contractor may submit the bid in person at the PUD office between 8:00 a.m. to 5:00 p.m. Monday through Friday. Alternatively, the Contractor may use the PUD drop box located outside the front office. The PUD makes no guarantee that bid packages submitted by mail will arrive prior to the bid deadline. Bidding documents for the project are prepared by Gray & Osborne and are available on the PUD's website: <https://mason-pud1.org/bids/>. All bid information, including addenda will be available on this site. All addenda must be signed and acknowledged and included as part of the bid packet.

BID OPENING:

A public bid opening will be held on Tuesday, March, 5, 2024, at 9:00 AM PST via Zoom.

Zoom Link Info: <https://us02web.zoom.us/j/86484398753>

Proposals are to be submitted only on the form provided with the Bid Documents. All Proposals must be accompanied by a certified check, postal money order, cashier's check, or Proposal bond payable to the "Mason County PUD No. 1" and in an amount of not less than five percent (5%) of the total Proposal amount.

DISTRICT OPTION TO REJECT ALL BID PROPOSALS:

The District may, at its sole discretion, reject any or all bid proposals submitted. The District shall not be liable for any costs incurred in connection with the preparation and submittal of any bid proposal. The District reserves the right to waive any informality in a submitted proposal.

SCOPE OF WORK:

The project includes the construction of a new 87,000-gallon reinforced concrete reservoir with booster pump station, standby generator, site piping, site improvements, security fencing, and temporary erosion and sedimentation control. An additive schedule of work includes installing approximately 350 feet of 4-inch pipe to construct a new intertie connection between the Union Ridge and Vuecrest water systems,

demolition and salvage of existing Vuecrest reservoir and booster station, and installation of fencing and gates around the new reservoir and booster station site. The Work shall be physically complete within 120 working days after the commencement date stated in the Notice to Proceed. All bidding and construction are to be performed in compliance with the Contract Provisions and Contract Plans for this project and any addenda issued thereto that are listed on the PUD's website: <https://mason-pud1.org/bids/>

For questions concerning bid documents, submittal requirements, or technical questions contact Brandy Milroy, Water Resource Manager at (360)877-5249 or brandym@mason-pud1.org.

PREPARATION AND CONTENT OF THE PROPOSAL:

Contractor must acknowledge receipt of any addenda (if applicable). The contractor is required to bid on the entirety of the Proposal. **Contractors and Subcontractors must be registered and active on Sam.gov to bid on this project.**

PRE-BID JOB SHOW:

A **mandatory** pre-bid job show is scheduled for Tuesday, February 13, 2024, at 10:00 a.m. The job show will begin at the project site at the end of E. Ridgecrest Dr. N., Union, WA 98592 promptly at 10:00 a.m. PST. Prospective bidders are required to participate.

COMPLIANCE WITH STATE & FEDERAL GRANTOR REGULATIONS:


Financing of the Project has been provided by the Mason County Commission's American Rescue Plan Act funding and the Washington State Department of Commerce. Since this project is funded through federal grants, therefore a SAM.GOV registration number is REQUIRED to bid this project.

PREVAILING WAGE:

All contractors and subcontractors are required to pay Washington State prevailing wages.

DISADVANTAGED BUSINESS ENTERPRISE:

Mason County PUD No. 1 is an equal opportunity employer; small, minority and women owned firms are strongly encouraged to apply.



Brandy Milroy, Water Resource Manager

CONTRACT PROVISIONS
TABLE OF CONTENTS
MASON COUNTY PUD NO. 1
VUECREST RESERVOIR AND BOOSTER STATION

PAGE NO.

CALL FOR BIDS

PART 1. BID DOCUMENTS

BIDDER’S CHECKLIST.....	BC-1
PROPOSAL.....	P-1 – P-7
PROPOSAL BOND.....	PB-1

PART 2. AGREEMENT AND BONDS

AGREEMENT.....	A-1 – A-3
PERFORMANCE BOND	B-1
PUBLIC WORKS PAYMENT BOND	B-2

PART 3. GENERAL CONDITIONS

PART 4. TECHNICAL SPECIFICATIONS

PART 5. WAGE RATES

PART 6. APPENDIX

Appendix A – Supplemental Bidder Responsibility Criteria
Appendix B – Temporary Construction Permits
Appendix C – Boring Logs (For Information Only)
Appendix D – Permits

PART 1

BID DOCUMENTS

BIDDER'S CHECKLIST

1. REQUIRED FORMS

The Bidder shall submit the following forms, which must be executed in full and submitted with the Proposal.

- a. Proposal (including Statement of Bidder's Qualifications) (Pages P-1 - P-7)
- b. Bid Deposit or Proposal Bond (PB-1)

2. SUPPLEMENTAL BIDDER CRITERIA

The Apparent two lowest bidders shall submit to the Contracting Agency the completed Supplemental Bidder Criteria forms in the Appendix by noon of the second business day following the bid submittal deadline.

3. AGREEMENT FORMS

The following forms (a., b., and c.) are to be executed and the Certificates of Insurance (d. and e.) are to be provided after the Contract is awarded and prior to Contract execution.

- a. Agreement (Pages A-1 - A-3)
- b. Performance Bond (Page B-1)
- c. Public Works Payment Bond (Page B-2)
- d. Certificate of Insurance
- e. Certificate of Builders Risk Insurance

VUECREST RESERVOIR AND BOOSTER STATION

PROPOSAL

Mason County PUD No. 1
21971 North Highway 101
Shelton, Washington 98584

The undersigned has examined the Work site(s), local conditions, the Contract, and all applicable laws and regulations covering the Work. The following unit and lump sum prices are tendered as an offer to perform the Work in accordance with all of the requirements set forth in the Contract and all applicable laws and regulations.

As required by the Contract, a postal money order, certified check, cashier's check or Proposal bond made payable to the Owner is attached hereto. If this Proposal is accepted and the undersigned fail(s) or refuse(s) to enter into a contract and furnish the required performance bond, labor and material payment bond, special guarantee bonds (if required), required insurance and all other required documentation, the undersigned will forfeit to the Owner an amount equal to five percent of the Proposal amount.

After the date and hour set for submitting the Proposals, no bidder may withdraw its Proposal, unless the Award of the contract is delayed for a period exceeding 60 consecutive calendar days.

The undersigned agrees that in the event it is Awarded the contract for the Work, it shall employ only Contractors and Subcontractors that are duly licensed by the State of Washington and remain so at all times they are in any way involved with the Work.

The undersigned agrees that the Owner reserves the right to reject any or all Proposals and to waive any minor irregularities and informalities in any Proposal.

The undersigned agrees that the Owner will Award the Contract to the lowest responsible, responsive bidder whose Proposal is in the best interest of the Owner. The Owner will determine at the time of award of the Contract which Additives, if any, will be included in the Contract.

PROPOSAL - Continued

<u>NO.</u>	<u>ITEM</u>	<u>QUANTITY</u>	<u>UNIT PRICE</u>	<u>AMOUNT</u>
1.	Mobilization and Demobilization	1 LS	\$_____	\$_____
2.	Minor Change	1 CALC	\$15,000.00	\$15,000.00
3.	Trench Excavation Safety Systems	1 LS	\$_____	\$_____
4.	Clearing and Grubbing	1 LS	\$_____	\$_____
5.	Locate Existing Utilities	1 LS	\$_____	\$_____
6.	Project Temporary Traffic Control	1 LS	\$_____	\$_____
7.	Erosion Control	1 LS	\$_____	\$_____
8.	Unsuitable Excavation	50 CY	\$_____	\$_____
9.	Sitework	1 LS	\$_____	\$_____
10.	Foundation Gravel	50 TN	\$_____	\$_____
11.	Bank Run Gravel	40 TN	\$_____	\$_____
12.	Crushed Surfacing Top Course	80 TN	\$_____	\$_____
13.	Crushed Surfacing Base Course	100 TN	\$_____	\$_____
14.	Site Restoration	1 LS	\$_____	\$_____
15.	Piping, Valves, and Appurtenances	1 LS	\$_____	\$_____
16.	Connection to Existing System	2 EA	\$_____	\$_____
17.	87,000-Gallon Concrete Reservoir and Foundation	1 LS	\$_____	\$_____
18.	Booster Station Building	1 LS	\$_____	\$_____
19.	Packaged Booster Station	1 LS	\$_____	\$_____
20.	Telephone Service	1 LS	\$_____	\$_____

PROPOSAL - Continued

<u>NO.</u>	<u>ITEM</u>	<u>QUANTITY</u>	<u>UNIT PRICE</u>	<u>AMOUNT</u>
21.	Electrical, Telemetry, and Instrumentation	1 LS	\$ _____	\$ _____

Subtotal:\$ _____

Washington State Sales Tax (8.5%):\$ _____

TOTAL CONSTRUCTION COST:\$ _____

ADDITIVE A:

<u>NO.</u>	<u>ITEM</u>	<u>QUANTITY</u>	<u>UNIT PRICE</u>	<u>AMOUNT</u>
1.	Fence and Gates	1 LS	\$ _____	\$ _____
2.	Intertie	1 LS	\$ _____	\$ _____
3.	Demolition	1 LS	\$ _____	\$ _____

Subtotal (Additive A):.....\$ _____

Washington State Sales Tax (8.5%):\$ _____

TOTAL CONSTRUCTION COST (ADDITIVE A):.....\$ _____

BID SUMMARY

1. TOTAL CONSTRUCTION COST
(BASE BID forwarded from above):.....\$ _____
2. TOTAL CONSTRUCTION COST
(ADDITIVE A forwarded from above):.....\$ _____
3. TOTAL CONSTRUCTION COST
(BASE BID AND ADDITIVE A)\$ _____

Note: A bid must be received on all items.

PROPOSAL - Continued

STATEMENT OF BIDDER'S QUALIFICATIONS

Name of Firm: _____

Address: _____

Telephone No. _____ Fax No. _____

Contact Person for this Project: _____

E-mail: _____

Number of years the Contractor has been engaged in the construction business under the present firm name, as indicated above:

WORK TO BE COMPLETED BY BIDDER

List the Work and the dollar amount thereof that the Bidder will complete with its forces, if awarded the contract.

Work to be Performed	Dollar Amount

PROPOSAL - Continued

PROPOSED SUBCONTRACTORS (Per RCW 39.30.060)

In accordance with RCW 39.30.060, for Proposals exceeding one million dollars, failure to list subcontractors with whom the bidder, if awarded the contract, will directly subcontract for performance of the work of structural steel installation, rebar installation, heating, ventilation and air conditioning, plumbing, as described in Chapter 18.106 RCW, and electrical, as described in Chapter 19.28 RCW or naming more than one subcontractor to perform the same work will result in your bid being non-responsive and therefore void.

These subcontractors must be listed below along with the work to be performed. This information must be provided with the Proposal or within one hour after the published bid submittal time for the work of heating, ventilation, air conditioning, plumbing and electrical. This information must be provided with the Proposal or within 48 hours after the published bid submittal time for the work of structural steel and rebar installation.

To the extent the Project includes one or more categories of work referenced in RCW 39.30.060, and no subcontractor is listed below to perform such work, the bidder certifies that the work will either (i) be performed by the bidder itself, or (ii) be performed by a lower tier subcontractor who will not contract directly with the bidder.

Subcontractor Name

Work to be performed

Subcontractor Name

Work to be performed

Subcontractor Name

Work to be performed

Subcontractor Name

Work to be performed

Subcontractor Name

Work to be performed

Bidder's are notified that it is the opinion of the enforcement agency that PVC or metal conduit, junction boxes, etc., are considered electrical equipment and therefore considered part of electrical work, even if the installation is for future use and no wiring or electrical current is connected during the project.

PROPOSAL - Continued

ADDENDA RECEIVED

Addendum No.	Date Received	Name of Recipient

NOTE: Bidder shall acknowledge receipt of all addenda. Bidder is responsible for verifying the actual number of addenda issued prior to submitting a Proposal.

Subject to any extensions of the Contract Time granted under the Contract, the undersigned agrees to substantially complete the Work required under this Contract within 120 working days (the Substantial Completion Date) and to physically complete the Work required under this contract within 130 working days (the Physical Completion Date) from when Contract Time begins.

The undersigned has reviewed and fully understands the provisions in the Contract regarding liquidated damages and agrees that liquidated damages shall be \$1,500.00 per day for each and every working day beyond the Contract Time allowed for substantial completion until the Substantial Completion Date is achieved and \$750.00 for each and every working day required beyond the Contract Time for physical completion until the Physical Completion Date is achieved.

The undersigned is, and will remain in, full compliance with all Washington State administrative agency requirements including, but not limited to registration requirements of Washington State Department of Labor & Industries for contractors, including but not limited to requirements for bond, proof of insurance and annual registration fee. The undersigned's Washington State:

Dept. of Labor and Industries Workman's Compensation Account No. is _____;
Dept. of Licensing Contractor's Registration No. is _____;
Unified Business Identifier Number is _____;
Excise Tax Registration Number is _____; and
Employment Security Account Number is _____.

The undersigned has reviewed all insurance requirements contained in the Contract and has verified the availability of and the undersigned's eligibility for all required insurance. The undersigned verifies that the cost for all required insurance, has been included in this Proposal.

In relation to claims related in whole or in part to workplace injuries to employees, the undersigned waives any immunity granted under the State Industrial Insurance Law, RCW Title 51. This waiver has been specially negotiated by the parties, which is acknowledged by the undersigned in signing this Proposal.

PROPOSAL - Continued

By signing the proposal, the undersigned declares, under penalty of perjury under the laws of the United States and the State of Washington, that the following statements are true and correct:

1. That the undersigned person(s) or entity(ies) has(have) not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with the project for which this Proposal is submitted.
2. The bidder hereby certifies that, within the three-year period immediately preceding the bid solicitation date 01/25/2024, that the bidder is not a “willful” violator, as defined in RCW 49.48.082, of any provision of chapters 49.46, 49.48, or 49.52 RCW, as determined by a final and binding citation and notice of assessment issued by the Department of Labor and Industries or through a civil judgment entered by a court of limited or general jurisdiction.

The undersigned agrees that the Owner is authorized to obtain information from all references included herein.

Sincerely,

_____ Sign Name	_____ Date
--------------------	---------------

By: _____	_____
Print Name, Title	Location Executed (City, State or County)

Print Company Name

Amount of Proposal deposit: \$ _____ Check No. _____,

or Proposal bond in the amount of \$ _____

_____, issued through _____
Name of Bank/Bonding Company

located at _____
Mailing Address

Telephone Number of Bank/Bonding Company

PROPOSAL BOND

KNOW ALL MEN BY THESE PRESENTS, That we _____

_____ of _____ as principal, and the _____

_____ a corporation duly organized under the laws of the state of _____, _____ and authorized to do business in the State of Washington, as surety, are held and firmly bound unto the **MASON COUNTY PUD NO. 1** in the full and penal sum of five percent of the total amount of the bid proposal of said principal for the work hereinafter described, for the payment of which, well and truly to be made, we bind our heirs, executors, administrators and assigns, and successors and assigns, firmly by these presents.

The condition of this bond is such, that whereas the principal herein is herewith submitting his or its sealed proposal for the following construction project, to wit:

VUECREST RESERVOIR AND BOOSTER STATION

said bid and proposal, by reference thereto, being made a part hereof.

NOW, THEREFORE, If the said proposal bid by said principal be accepted, and the contract be awarded to said principal, and if said principal shall duly make and enter into and execute said Contract and shall furnish bond as required by the **MASON COUNTY PUD NO. 1** within a period of 10 days from and after said award, exclusive of the day of such award, then this obligation shall be null and void, otherwise it shall remain and be in full force and effect.

IN TESTIMONY WHEREOF, The principal and surety have caused these presents to be signed and sealed this _____ day of _____, _____.

(Principal)

(Surety)

(Attorney-in-fact)

PART 2

AGREEMENT AND BONDS



AGREEMENT BETWEEN OWNER AND CONTRACTOR

The Effective Date of this Contract is:	
<u>The Parties to this Contract are:</u>	
The “Owner”	Mason County Public Utility District No. 1
The “Contractor”	
Project Name:	
The “Architect” or “Engineer:”	
The “Work:”	See “Scope of Work,” Exhibit <u>A</u>
Alternates included in the Contract Sum:	
Contract Sum for the Work: <i>(not including sales tax)</i>	\$
Payments: <i>(check one)</i>	<input type="checkbox"/> The Owner will make a single payment to the Contractor within thirty (30) days of Final Acceptance. <input type="checkbox"/> See Supplemental Conditions
Date of Substantial Completion of the Work:	
Date of Final Completion of the Work:	___ days after Substantial Completion
Liquidated Damages:	\$___ per day for each calendar day beyond the Contract Time that Substantial Completion is not achieved.
Owner’s Permit Responsibilities:	
Unit Prices:	
<u>Minimum Required Insurance:</u>	
Commercial General Liability:	At least \$1 million per occurrence and general aggregate.
Automobile Liability:	At least \$1 million
Workers’ Compensation (industrial insurance):	At least the State statutory amount
Employer’s Liability:	At least \$1 million
Aircraft Liability:	At least \$5 million
Watercraft Liability:	At least \$1 million
Property Insurance:	Full insurable value
Boiler and Machinery Insurance:	
Additional Insureds:	Mason County PUD No. 1

The Owner and Contractor agree as set forth below.

ARTICLE 1: THE WORK. The Contractor shall fully execute and complete the entire Work described in the Contract Documents, including the Alternates listed above.

ARTICLE 2: COMMENCEMENT AND SUBSTANTIAL AND FINAL COMPLETION.

2.1 The date of commencement of the Work is the date of this Agreement. The Contract Time is measured

from the date of commencement to the date of Substantial Completion specified above, as it may be adjusted under the Contract Documents.

2.2 The Contractor shall achieve Substantial Completion and Final Completion of the entire Work within the dates specified above, subject to adjustments of the Contract Time as provided in the Contract Documents.

ARTICLE 3: THE CONTRACT SUM. The Owner shall pay the Contractor the Contract Sum for the Contractor's performance of this Contract, subject to additions and deductions as provided in the Contract Documents. Sales tax is not included in the Contract Sum.

ARTICLE 4: PAYMENT. The Owner will pay the Contractor within *thirty (30) days* of receipt of an approved Application for Payment in accordance with this Contract. Retainage will be released in accordance with statutory requirements.

ARTICLE 5: PERMITS AND FEES.

5.1 The Owner will secure and pay for only those governmental permits, approvals, fees, licenses, inspections, governmental charges and inspection fees listed on the cover page.

5.2 The Contractor shall secure and pay for all other governmental permits, approvals, fees, licenses, inspections, governmental charges and inspection fees required for the prosecution of the Work.

ARTICLE 6: ENUMERATION OF CONTRACT DOCUMENTS.

6.1 The Contract Documents form this Contract. This Contract represents the entire and integrated agreement between the parties and supersedes prior negotiations, representations or agreements, either written or oral. The Contract Documents shall not be construed to create a contractual relationship of any kind between the Owner and a Subcontractor of any tier, between any Architect and the Contractor, or between any persons or entities other than the Owner and the Contractor.

6.2 The Contract Documents are enumerated as follows and, in the event of a conflict or discrepancy among or in the Contract Documents, interpretation shall be governed in the following order of priority:

1. Agreement
2. Prevailing wage rates set by L&I as of the bid date for Mason County (available at <http://www.lni.wa.gov/TradesLicensing/PrevWage/WageRates/default.asp>)
3. General Conditions
4. Scope of Work (See **Exhibit A**)
5. Drawings and Specifications (Refer to Bid Package)

OWNER

By _____
(Signature)

(Printed name and title)

CONTRACTOR

By _____
(Signature)

(Printed name and title)

GENERAL CONDITIONS

ARTICLE 7 THE CONTRACT DOCUMENTS

7.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contractor's performance shall be consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the intended results.

7.2 "Work" means the construction and services required by the Contract Documents and includes all labor, materials, equipment and services to be provided by the Contractor to fulfill its obligations.

7.3 If the Contractor finds a conflict, error or discrepancy in the Contract Documents, the Contractor shall report it to the Owner in writing at once. The Contractor shall not proceed with the affected Work until it receives a written interpretation or clarification from the Owner.

ARTICLE 8 ADMINISTRATION OF THE CONTRACT

8.1 The Owner will provide administration of the Contract. If an Architect or Engineer is also involved, its duties beyond those addressed in these General Conditions will be described in an attachment to this Contract.

8.2 Authority. The Owner must approve in writing all changes in the Contract Sum or Contract Time as well as all Change Orders, Construction Change Directives, and payments to the Contractor. The Owner will make any modification or release of any requirement of the Contract Documents, or any approval or acceptance of any portion of the Work, whether or not executed in accordance with the Contract Documents, exclusively in writing.

8.3 Rejection of Work. The Owner may reject Work that, in its opinion, does not conform to the Contract Documents. If the Contractor fails to correct Work that is not in accordance with the Contract Documents or fails to carry out the Work in accordance with the Contract Documents, the Owner may order the Contractor in writing to stop the Work, or any portion thereof, until the cause for that order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right.

8.4 Site Access. The Owner shall have access to and may visit the Work site at intervals it considers appropriate to the stage of the Work to become generally familiar with the progress and quality of the completed Work, but the Owner will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work.

8.5 Submittals. The Contractor shall review, approve and submit to the Owner with reasonable promptness shop drawings, product data, samples and similar submittals required by the Contract Documents. The Owner will review and approve or take other appropriate action upon the Contractor's submittals for the limited purpose of checking for conformance with information given and the design concept expressed by the Contract Documents. The Work shall be in accordance with approved submittals. The Owner's review and approval does not relieve the Contractor of responsibility for compliance with the Contract Documents. The Contractor shall submit to the Owner any proposed change to or deviation from previously approved documents or submittals.

ARTICLE 9 THE CONTRACTOR

9.1 Using its best skill and attention, the Contractor shall perform, supervise and direct the Work. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences, procedures and personnel, for safety, and for coordinating all portions of the Work under this Contract. The Contractor shall provide and pay for all labor, materials, equipment, tools and machinery, water, heat, utilities, transportation, and other facilities and services necessary for the proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

9.2 Subcontractors. A "Subcontractor" is a person or entity that has a direct contract with the Contractor to perform a portion of the Work at the site or to supply materials or equipment. A "Subcontractor of any tier" includes Subcontractors and lower-level subcontractors and suppliers.

9.2.1 Identification. As soon as practicable and no later than *fourteen (14) days* after award of this Contract, the Contractor shall confirm to the Owner in writing the names of the Subcontractors for each portion of the Work.

9.2.2 Subcontracts. Contracts between the Contractor and Subcontractors shall require each Subcontractor to be bound to the Contractor by the terms of the Contract Documents for the Work to be performed by the Subcontractor and to assume toward the Contractor all the obligations and responsibilities that the Contractor, by the Contract Documents, assumes toward the Owner.

9.2.3 **Payment.** The Contractor shall promptly pay (and secure the discharge of any liens asserted by) all persons properly furnishing labor, equipment, materials or other items in connection with the performance of the Work for which the Owner has paid (including, but not limited to, workers and Subcontractors). The Contractor shall furnish to the Owner releases of liens and claims and other documents that the Owner requests from time to time to evidence such payment (and discharge). Nothing in the Contract Documents shall obligate the Owner to pay or to cause the payment of any moneys due to any Subcontractor of any tier or other person or entity, except as may otherwise be required by law or regulation.

9.3 **Workers.** The Contractor shall enforce strict discipline and good order among persons carrying out the Work and shall not permit employment of unfit persons or persons not skilled in tasks assigned to them. At no change to the Contract Sum or Contract Time, the Owner may provide written notice requiring the Contractor to remove from the Work any employee or other person carrying out the Work that the Owner considers objectionable.

9.4 **Warranty.** The Contractor warrants that materials and equipment furnished under this Contract will be of good quality and new, that the Work will be performed in a workmanlike manner, free from defects not inherent in the quality required, and that the Work will conform with the requirements of the Contract Documents.

9.5 **Progress Schedule.** Within *fourteen (14) days* of execution of this Contract, the Contractor shall submit a schedule of the Work to the Owner ("Progress Schedule"). The Contractor will be responsible for planning, scheduling, managing, and reporting the progress of the Work in accordance with all of the specific methods and submittals described in the Contract Documents. The Contractor shall use the Progress Schedule (as updated) to plan, coordinate, and prosecute the Work in an orderly and expeditious manner.

9.6 **Clean-Up.** The Contractor shall keep the site and surrounding area free from accumulation of waste materials caused by operations under the Contract.

9.7 **Indemnification.**

9.7.1 Subject to the following conditions and to the fullest extent permitted by law, the Contractor shall defend, indemnify and hold harmless the Owner and its agents, employees, consultants, successors and assigns (together, the "Indemnified Parties") from and against all claims, damages, losses and expenses, direct and indirect, or consequential, including but not limited to costs, attorneys' fees, and other litigation expenses incurred on such claims and in proving the right to indemnification, arising out of or resulting from the performance of the Work by or any act or omission of the Contractor, its agents, any Subcontractor of any tier, and anyone directly or indirectly employed by them (together, the "Indemnitor").

.1 The Contractor will fully indemnify and defend the Indemnified Parties for the sole negligence of the Indemnitor.

.2 The Contractor will indemnify and defend the Indemnified Parties for the concurrent negligence of the Indemnitor only to the extent of the Indemnitor's negligence. The Contractor agrees to being added by the Owner as a party to any mediation, arbitration or litigation with third parties in which the Owner alleges indemnification or contribution from the Indemnitor. The Contractor agrees that all of its Subcontractors of any tier will similarly stipulate in their subcontracts. To the extent a court or arbitrator strikes any portion of this indemnification provision for any reason, all remaining provisions shall retain their vitality and effect.

9.7.2 After mutual negotiation of the parties, the indemnification obligation shall not be limited by the amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts in claims by an employee of the Contractor or a Subcontractor of any tier against any person or entity indemnified under this Paragraph 9.7. For the sole purpose of effecting the indemnification obligations under this Contract and not for the benefit of any third parties unrelated to the Owner, the Contractor specifically and expressly waives any immunity that may be granted it under Title 51 RCW, "Industrial Insurance." IF THE CONTRACTOR DOES NOT AGREE WITH THIS WAIVER, IT MUST PROVIDE A WRITTEN NOTICE TO THE OWNER PRIOR TO THE DATE FOR THE RECEIPT OF BIDS, OR THE CONTRACTOR WILL BE DEEMED TO HAVE NEGOTIATED AND WAIVED THIS IMMUNITY.

9.8 **Records.** The Contractor shall maintain and preserve books, ledgers, records, estimates, correspondence, logs, schedules, electronic data and other documents relating or pertaining to the costs and/or performance of the Contract ("records"). Within *seven (7) days* of the Owner's request, the Contractor shall make available at the Contractor's office all records for inspection, audit and reproduction (including electronic reproduction) by the Owner's representatives. These requirements apply to each Subcontractor of any tier. The Contractor agrees, on behalf of itself and Subcontractors of any tier, that the invocation of any rights under RCW 42.56 shall initiate an equivalent right to disclosures from the Contractor and Subcontractors of any tier for the benefit of the Owner.

9.9 **Compliance with Law.** The Contractor, its employees, Subcontractors of any tier and representatives, shall comply with all applicable laws, ordinances, statutes, rules and regulations, federal and state, county and municipal.

9.9.1 **Prevailing Wages.** The Contractor shall comply with all applicable provisions of RCW 39.12, including but not limited to submission of approved "Statements of Intent to Pay Prevailing Wage," payment of all Labor & Industries' fees, submission and posting of approved "Statements of Intent to Pay Prevailing Wages" and payment of prevailing wages. The State of Washington prevailing wage rates applicable for this public works project, which is located in Mason County, may be found at the following website

address of the L&I: <http://www.lni.wa.gov/TradesLicensing/PrevWage/WageRates/default.asp>. The Contractor shall keep a paper copy at the Project site.

9.9.2 Hours of Labor. The Contractor shall comply with all applicable provisions of RCW 49.28.

9.9.3 Worker's Right to Know. The Contractor shall comply with RCW 49.70 and WAC 296-62-054 regarding workplace surveys and material safety data sheets for "hazardous" chemicals at the Project site.

ARTICLE 10 **CONSTRUCTION BY THE OWNER OR BY SEPARATE CONTRACTORS**

10.1 The Owner may perform construction or operations related to the Project with its own forces and may award separate contracts in connection with other portions of the Project or other construction or operations on the site under contractual conditions consistent with those of the Contract Documents.

10.2 The Contractor shall afford the Owner and separate contractors reasonable opportunity for the introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations.

ARTICLE 11 **CHANGES IN THE WORK**

11.1 The Owner, without invalidating this Contract, may order changes in the Work consisting of additions, deletions or modifications ("Changes"), and the Contract Sum and Contract Time will be adjusted accordingly. Changes in the Work, in the Contract Sum and/or in the Contract Time shall be authorized only by written Change Order signed by the Owner and the Contractor or by written Construction Change Directive signed by the Owner.

11.1.1 Change Orders. A Change Order is a written instrument signed by the Owner and the Contractor stating their agreement upon a change in the Work, the amount of any adjustment in the Contract Sum, and the extent of any adjustment in the Contract Time.

11.1.2 Construction Change Directives. A Construction Change Directive is a written order prepared and signed by the Owner that directs a change in the Work and states a proposed basis for any adjustment in the Contract Sum and/or Contract Time. It is used in the absence of total agreement on the terms of a Change Order. The Contractor shall promptly proceed with the change in the Work described in the Construction Change Directive. As soon as possible, and within *seven (7) days* of receipt, the Contractor shall advise the Owner in writing of the Contractor's agreement or disagreement with the cost or the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

11.2 **Costs of Changes and Claims.** If the parties cannot agree on the cost or credit to the Owner from a Construction Change Directive or other Change in the Work, the Contractor and all affected Subcontractors of any tier shall keep and present an itemized accounting with supporting data. The total cost of any Change or Claim shall be limited to the reasonable value of the direct labor costs, material costs, construction equipment usage costs for the actual time equipment appropriate for the Work is used solely on the Change in the Work, the cost of any change in insurance, Subcontractor costs, and a fee for all combined overhead and profit, including impact costs of any kind, limited to twelve percent (12%) of the cost for any materials or work performed by the forces of the Contractor or a Subcontractor and eight percent (8%) of amounts due to Subcontractors.

11.3 **Claims for Concealed or Unknown Conditions.** If conditions are encountered at the site that are (1) concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found and generally recognized as inherent in activities of the character provided for in the Contract Documents, then the Contractor shall give written notice to the Owner promptly before conditions are disturbed and in no event later than *seven (7) days* after the first observance of the conditions. The Contractor shall make any Claim arising from such condition in accordance with the dispute resolution procedures of Article 19.

ARTICLE 12 **TIME**

12.1 **Delay.**

12.1.1 Time. If the Work is delayed by changes ordered in the Work, unanticipated general labor disputes, fire, unusual delay in deliveries, abnormal adverse weather conditions not reasonably anticipatable, unavoidable casualties or any other causes beyond the Contractor's control, then the Contract Time shall be extended by Change Order to the extent the critical path is affected.

12.1.2 Damages. The Contractor and Sub-contractors shall be entitled to damages for delay only where the Owner's actions or inactions were the actual, substantial cause of the delay and where the Contractor could not have reasonably avoided the delay by the exercise of due diligence.

12.1.3 **Contractor Delay.** If a delay was caused by the Contractor, a Subcontractor of any tier, or anyone acting on behalf of any of them, the Contractor is not entitled to an increase in the Contract Time or in the Contract Sum.

12.2 Completion and Liquidated Damages. The timely completion of the Project is essential to the Owner. The Owner will incur serious and substantial damages if Substantial Completion of the Work does not occur within the Contract Time. The Contractor is responsible for actual damages for delay unless an amount is inserted on the cover page for liquidated damages, in which case the liquidated damage amount shall apply. Liquidated damages shall not be affected by partial completion, occupancy, or beneficial occupancy.

ARTICLE 13

PAYMENTS AND COMPLETION

13.1 Payments. Payment shall be made as provided in this Contract, including any Supplemental Conditions.

13.2 Withheld Payment. The Owner may withhold payment in whole or in part, or it may nullify the whole or part of a payment previously issued, on account of (1) defective Work not remedied, (2) claims or liens filed by third parties, (3) failure of the Contractor to make payments due to Subcontractors or for labor, materials or equipment, (4) damage to the Owner or another contractor, (5) reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum, (6) reasonable evidence that the unpaid balance would not be adequate to cover actual or liquidated damages for delay for which the Contractor is responsible, (7) failure to carry out the Work in accordance with the Contract Documents, or (8) liquidated damages. The Owner will provide the Contractor with written notice of its intent to implement this provision and provide details supporting the Owner's intention. The Contractor will be afforded reasonable time following receipt of such notice to respond to or correct the circumstances provoking this action by the Owner.

13.3 Substantial Completion.

13.3.1 Substantial Completion is the stage in the progress of the Work when the construction is sufficiently complete, in accordance with the Contract Documents, so the Owner can fully utilize the Work (or a designated portion) for its intended use. All Work other than incidental corrective or punchlist work and final cleaning shall have been completed. The Work is not Substantially Complete if all systems and parts affected by the Work are not usable, any required occupancy or use permit has not been issued, or if utilities affected by the Work are not connected and operating normally. The fact that the Owner may use or occupy some or all of the Work does not indicate that the Work is Substantially Complete, nor does it toll or change any liquidated damages due the Owner.

13.3.2 When the Contractor believes that the Work has achieved Substantial Completion, it shall notify the Owner in writing. When the Owner agrees, it will issue a Certificate of Substantial Completion.

13.3.3 Immediately before any occupancy, the Owner will schedule an inspection tour of the area to be occupied. Representatives of the Owner and the Contractor will jointly tour the area and record items still remaining to be finished and/or corrected. The Contractor shall promptly supply and install any such items as well as items missed by the inspection but required or necessary for Final Completion as a part of the Contract Sum.

13.4 Final Completion. After the Contractor has notified the Owner that the Work has been concluded, and the Contractor has submitted the items listed below as may be required at the discretion of the Owner, the Owner will determine in writing that Final Completion has occurred.

- .1 A final Application for Payment.
- .2 An affidavit that all payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or its property might in any way be responsible or encumbered, have been paid or otherwise satisfied.
- .3 Consent of surety to final payment.
- .4 A certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be cancelled or allowed to expire until at least thirty (30) days' prior written notice has been given to the Owner.
- .5 A written statement that the Contractor knows of no substantial reason why the insurance will not be renewable to cover the period required by the Contract Documents.
- .6 Other data establishing payment or satisfaction of or protection (satisfactory to the Owner) against all obligations, such as receipts, releases and waivers of liens and claims.
- .7 Pursuant to RCW 39.12.040, an "Affidavit of Wages Paid" from the Contractor and from each Subcontractor certified by the Industrial Statistician of the Department of Labor and Industries, with the fees paid by the Contractor or Subcontractor.

.8 A certified statement that the Contractor has closed all necessary permits or otherwise met the requirements of all governing jurisdictions related to this Project.

.9 Pursuant to RCW 60.28.020, certificates from the Department of Revenue and the Department of Labor and Industries.

.10 Pursuant to RCW 50.24, a certificate from the Department of Employment Security.

.11 All deliverables required by the Contract Documents.

.12 A certification that the materials in the Work are "lead-free" and "asbestos free."

.13 A legible hard copy of the as-built drawings.

13.5 Final Acceptance and Final Payment.

13.5.1 Pursuant to RCW 60.28, completion of the contract Work shall occur after Final Completion has been achieved and the Owner has formally accepted the Project ("Final Acceptance"). Final Payment shall not become due until after Final Acceptance.

13.5.2 If any Subcontractor of any tier refuses to furnish a release or waiver required by the Owner, the Owner may retain an amount to defray the cost of foreclosing the liens of such claims and to pay attorneys' fees, the total of which shall be no less than one hundred fifty percent (150%) of the claimed amount. If any such lien remains unsatisfied after all payments are made, the Contractor shall refund to the Owner all moneys that the latter may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

13.6 Waivers.

13.6.1 Final Payment by the Owner. The making of final payment constitutes a waiver of claims by the Owner except those arising from (1) liens, claims, security interests, or encumbrances arising out of the Contract and unsettled; (2) failure of the Work to comply with the requirements of the Contract Documents; (3) Work subsequently found to be substandard and/or deficient; or (4) terms of warranties required by the Contract Documents or law.

13.6.2 Final Payment to the Contractor. Acceptance of final payment by the Contractor constitutes a waiver of Claims except those previously made in writing and specifically identified as unsettled on the final Application for Payment.

13.6.3 Change Orders. The execution of a Change Order constitutes a waiver of Claims by the Contractor arising out of the Work to be performed or deleted pursuant to the Change Order, except as specifically described in the Change Order.

13.6.4 Reservation of Rights. If the Contractor adds to a Change Order, a Construction Change Directive, or any other document a reservation of rights that has not been initialed by the Owner, any amounts previously agreed shall be considered disputed and not yet payable unless the costs are re-negotiated or the reservation is withdrawn or changed in a manner satisfactory to and initialed by the Owner.

13.6.5 Failure to Exercise. The Owner's failure to exercise any of its rights under this Contract shall not constitute a waiver of any past, present or future right or remedy. Any waiver by the Owner of any right or remedy under this Contract must be in writing and shall apply only to the right or remedy specified.

13.7 Warranty of Title. The Contractor warrants and guarantees that title to the Work, materials and equipment covered by an Application for Payment, whether or not incorporated in the Project, will pass to the Owner no later than the time of payment, free and clear of liens.

ARTICLE 14 **PROTECTION OF PERSONS AND PROPERTY**

14.1 The Contractor shall be solely responsible, and the Owner shall not have responsibility, for all aspects of safety related to this Contract or the Work, including initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract. The Contractor shall take reasonable precautions for the safety of, and shall provide reasonable protection to prevent damage, injury or loss to, persons or property.

14.2 The Contractor shall promptly remedy to the Owner's satisfaction damage or loss to property at the site caused in whole or in part by the Contractor, a Subcontractor of any tier, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable, except for damage or loss attributable to acts or omissions of the Owner or by anyone for whose acts the Owner may be liable that are not attributable to the fault or negligence of the Contractor or a Subcontractor of any tier.

14.3 The Contractor shall not be required to perform without consent any Work relating to asbestos or polychlorinated biphenyl, unless identified as such in the Contract Documents.

ARTICLE 15

INSURANCE AND BONDS

15.1 The Contractor shall, at its own cost, purchase from a company or companies authorized to do business in the State of Washington possessing a Best's policyholder's rating of A- or better and a financial rating of no less than VII, and reasonably acceptable to the Owner, and maintain during the life of this Contract, at least the following insurance. The Contractor shall also cause its Subcontractors of any tier to secure and maintain at least the following insurance. The insurance shall be in force at the time the Work is commenced and shall remain in force until Substantial Completion, unless a later date is specified below.

15.1.1 Contractor's Liability Insurance. The Contractor shall purchase and maintain an occurrence-based Commercial General Liability Insurance Policy and such other insurance as will provide protection from claims set forth below which may arise out of or result from Contractor's operations under the Contract Documents, whether to be performed or furnished by Contractor, by any Subcontractor, by anyone directly or indirectly employed by any of them to perform or furnish any of the Work, or by anyone for whose acts any of them may be liable:

.1 Claims under workers' compensation, disability benefits and other similar employee benefit acts, as required by the laws of the state of Washington, including Contingent Employers Liability (Stop Gap) for all employees of the Contractor and Subcontractors;

.2 If there is an exposure for injury to Contractor's or subcontractors' employees under the United States Longshoremen's and Harbor Workers' Compensation Act, the Jones Act or under laws, regulations or statutes applicable to maritime employees, or any similar laws, regulations or statutes, coverage shall be included for such injuries or claims.

.3 Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees and of any person other than the Contractor's employees;

.4 Claims for damages insured by personal injury liability coverage that are sustained (a) by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or (b) by any other person for any other reason.

.5 Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom;

.6 Claims arising out of operation of laws or regulations for damages because of bodily injury or death of any person or for damage to property;

.7 Claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle, including coverage for Owned Motor Vehicles, Non Owned Motor Vehicles and Hired or Borrowed Motor Vehicles; and

.8 The comprehensive general liability insurance required by this paragraph must include contractual liability insurance applicable to Contractor's obligations under Paragraph 9.7.

15.1.2 Property Insurance. Unless otherwise provided in the Contract Documents, the Contractor shall purchase and maintain property insurance upon the Work at the site to the full insurable value thereof (subject to any deductible amounts that may be provided in the Contract Documents). This insurance shall include the interest in the Work of the Owner, Contractor, Subcontractors of any tier, any Architect and consultants, all of whom shall be listed as insureds or primary, non-contributing additional insured parties. Additional insured status shall be evidenced by internal policy provision or by separate external endorsement. This insurance shall insure against the perils of fire and extended coverage and shall include "all risk" insurance for physical loss and damage including, without duplication of coverage, theft, vandalism and malicious mischief, collapse, false work and water damage, temporary buildings and debris removal (including demolition occasioned by enforcement of any applicable legal requirements), and such other perils as may be provided in the Contract Documents, and shall include damages, losses and expenses arising out of or resulting from any insured loss or incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers, architects, attorneys and other professionals). If not covered under the "all risk" insurance or otherwise provided in the Contract Documents, the Contractor shall purchase and maintain similar property insurance on portions of the Work stored on and off the site or in transit when such portions of the Work are to be included in an Application for Payment. The Owner shall bear no responsibility for such portions of the Work or the consequences of their damage or loss.

15.1.3 Boiler and Machinery Insurance. The Contractor shall purchase and maintain such boiler and machinery insurance for applicable equipment utilized or contained in the Work, which will include the interests in the Work of the Owner, Contractor, Subcontractors, any Architect, and consultants, all of whom shall be listed as insured or additional insured parties.

15.1.4 Aircraft/Watercraft Insurance. If the performance of the Work requires the use of any aircraft that are owned, leased, rented, or chartered by the Contractor or any of its Subcontractors, the Contractor shall secure and maintain Aircraft Liability Insurance for property damage and bodily injury, including passengers and crew. If the performance of the Work requires the use of any watercraft that are owned, leased, rented or chartered by the Contractor or any of its subcontractors, the Contractor shall secure and maintain Watercraft Liability insurance for property damage and bodily injury.

15.3 The Owner's specification or approval of insurance in this Contract or of its amount shall not relieve, limit or decrease the liability of the Contractor under the Contract Documents or otherwise. Coverages are the minimum to be provided and are not limitations of liability under the Contract, indemnification, or applicable law provisions. The Contractor may, at its expense, purchase larger coverage amounts or additional insurance.

15.4 Waiver of Rights

15.4.1 The Owner and Contractor waive all rights against each other for losses and damages caused by any of the perils covered by the policies of insurance provided in response to Paragraphs 15.1.2 and 15.1.3 and any other property insurance applicable to the Work, and also waive such rights against the Subcontractors, Architect, consultants and other parties named as insureds in such policies for losses and damages so caused. Each subcontract between the Contractor and a Subcontractor will contain similar waiver provisions by the Subcontractor in favor of the Owner, Contractor, Architect, consultants and all other parties named as insureds. None of these waivers shall extend to the rights that any of the insured parties may have to the proceeds of insurance held by the Owner as Trustee or otherwise payable under any policy so issued.

15.4.2 The Owner and Contractor intend that any policies provided in response to Paragraphs 15.1.2 and 15.1.3 shall protect the parties insured and provide primary coverage for losses and damages caused by the perils covered thereby. Accordingly, such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any of the parties named as insureds or additional insureds, and if the insurers require separate waiver forms to be signed by the Architect or its consultant, the Owner will obtain the same, and if such waiver forms are required of any Subcontractor, the Contractor will obtain the same.

15.5 Any insured loss under the policies of insurance required by Paragraphs 15.1.2 and 15.1.3 will be adjusted with the Owner and made payable to the Owner as Trustee for the insureds, as their interests may appear, subject to the requirements of any applicable mortgage clause. The Owner shall deposit in a separate account any money so received, and shall distribute it in accordance with such agreement as the parties in interest may reach. If no agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof, and the Work and the cost thereof covered by an appropriate Contract Modification or Written Amendment, or be a separate contract, at the Owner's option.

15.6 Endorsements.

15.6.1 The Owner, its officer and employees shall be named as a primary, non-contributing additional insured and coverage shall apply on a primary and non-contributory basis on such policies other than Workers' Compensation. Additional insured status shall be evidenced by internal policy provision or by separate external endorsement. Policies shall contain a provision that the Owner shall be given *thirty (30) days'* written notice by certified mail before cancellation of any insurance or reduction of the amount thereof, or any alteration, modification, restriction or material change thereto. No such cancellation, reduction, alteration, modification, restriction or material change in any policy shall relieve the Contractor of its obligation to maintain coverages in accordance with the Contract Documents.

15.6.2 All insurance policies to be maintained by the Contractor shall provide for Waiver of Subrogation in favor of the Owner.

15.6.3 All insurance policies, except Workers' Compensation, to be maintained by the Contractor shall provide Severability of Interests or Cross Liability Clause and provide that the insurance shall be primary and not excess to or contributing with any insurance or self-insurance maintained by the Owner.

15.7 Certificates evidencing that satisfactory coverage of the type and limits set forth in the Contract Documents shall be furnished to the Owner in a form acceptable to the Owner and shall contain provisions consistent with Paragraph 15.6.

15.8 Irrespective of the requirements of the Contract Documents as to insurance to be carried by the Contractor, insolvency, bankruptcy or failure of any insurance company to pay all claims accruing, shall not be held to relieve the Contractor of any of its obligations.

15.9 The Contractor shall defend, indemnify and hold the Owner harmless from any failure of the Contractor or its Subcontractors of any tier to secure and maintain insurance as required by this Contract.

ARTICLE 16 CORRECTION OF WORK

16.1 The Contractor shall promptly correct Work rejected or failing to conform to the requirements of the Contract Documents at

any time through a period of *one (1) year* from the date of Substantial Completion of this Contract or by terms of a longer manufacturer's warranty or an applicable special warranty required by the Contract Documents.

16.2 If the Contractor fails to carry out or correct Work that is not in accordance with the Contract Documents, the Owner may, by written order, require the Contractor to stop the Work or any portions thereof until the cause for the order has been eliminated, and the Owner may take over and correct some or all of the non-conforming Work at the Contractor's cost.

16.3 Nothing in this Article shall be construed to establish a period of limitation with respect to other obligations that the Contractor might have under the Contract Documents.

ARTICLE 17

MISCELLANEOUS PROVISIONS

17.1 Applicable Law. This Contract shall be governed by the internal law of the State of Washington, without regard to its choice-of-law provisions.

17.2 Compliance with Law. The Contractor shall give notices and comply with applicable laws, rules, regulations and orders of public authorities, including but not limited to RCW 39.06 and RCW 18.27 (Registration), RCW 49.60 (Discrimination), RCW 70.92 (Aged and Handicapped Persons), WAC 296-155 (Safety Standards), RCW 50.24 (Unemployment Compensation), RCW 51 (Industrial Insurance); RCW 82 (State Excise Tax Registration), RCW 39.12.065(3) (prevailing wage violations), Drug-Free Workplace Act of 1988 (Drug-Free Workplace) and RCW 49.26 (any asbestos removal).

17.3 Assignment. The Contractor shall not let, assign or transfer this Contract, or any interest in it or part of it, without the written consent of the Owner.

17.4 The Owner's Site Rules. The Contractor shall comply with the Owner's site and conduct rules.

17.5 Survival of Clauses. The warranty, dispute resolution, and indemnification provisions of this Contract shall survive the termination, cancellation or expiration of this Contract.

17.6 Writing Required. No addition to or modification of this Contract or waiver of any provisions of this Contract shall be binding on either Party unless explicitly made in writing and executed by the Contractor and the Owner.

17.7 Safety Standards. Contractor shall comply with require adequate safety systems for the trench excavation that meet the requirements of the Washington industrial safety and health act, chapter 49.17 RCW. The Contractor shall comply with pertinent provisions of Chapter 296-155 WAC, "Safety Standards for Construction Work," including without limitation trench safety requirements of RCW 39.04.180.

ARTICLE 18

TERMINATION OF THE CONTRACT

18.1 Termination for Cause by the Contractor. If the Owner fails to make payment of undisputed amounts for a period of *sixty (60) days* through no fault of the Contractor, the Contractor may, upon *seven (7) additional days'* written notice (during which time the Owner has the right to cure), terminate the Contract and recover from the Owner payment for all Work executed in accordance with the Contract Documents.

18.2 Termination for Cause by the Owner. The Owner may, upon *seven (7) days'* written notice to the Contractor, terminate without prejudice the whole or any portion of the Work for cause, including but not limited to the Contractor's material breach of this Contract; failure to prosecute the Work or any portion thereof with sufficient diligence to ensure the Substantial Completion of the Work within the Contract Time; failure to supply a sufficient number of properly skilled workers or proper materials; material disregard of laws, ordinances, rules, regulations or orders of any public authority having jurisdiction; or being adjudged bankrupt, making a general assignment for the benefit of its creditors, or having a receiver appointed on account of the Contractor's insolvency.

18.3 Termination for Convenience by the Owner. The Owner may, at any time upon *seven (7) days'* written notice to the Contractor, terminate (without prejudice to any right or remedy of the Owner) the whole or any portion of the Work for the convenience of the Owner. The Owner shall be liable to Contractor only for the amount reasonably incurred to date and due under Article 13 for the performance of the Work terminated and other pre-approved costs, consistent with the Paragraph 11.2, necessary and reasonably incurred in connection with the termination of the Work.

18.4 Effects of Termination.

18.4.1 The total sum to be paid to the Contractor under this Article 18 shall not exceed the Contract Sum as reduced by the amount of payments otherwise made.

18.4.2 Unless the Owner directs otherwise, after receipt of a notice of termination by the Owner, the Contractor shall promptly stop Work as specified in the notice of termination; place no further orders or subcontracts, except as necessary for completion of non-terminated Work; procure cancellation of all orders and subcontracts to the extent related to the performance of terminated Work; assign to the Owner all of the right, title and interest of the Contractor under all orders and subcontracts; with the Owner's approval, settle outstanding liabilities and claims arising out of such termination of orders and subcontracts not assigned to the Owner; transfer title and deliver to the entity or entities designated by the Owner the fabricated or unfabricated parts, Work in process, partially completed supplies and equipment, materials, parts, tools, dies, jigs and other fixtures, completed Work, supplies and other material produced as part of, or acquired in connection with the performance of, the Work terminated, and the completed or partially completed plans, drawings, information and other property related to the Work; take such action as may be necessary or as directed by the Owner to preserve and protect the Work and property related to the Project in the possession of the Contractor in which the Owner has an interest; and continue performance only to the extent not terminated.

18.5 Suspension. The Owner may, at its option and at any time, suspend the Contractor's performance of some or all of the Work. The Owner will give the Contractor notice of any such suspension, including the scope of the suspension and the Owner's estimate of the duration of such suspension. During the period of suspension, the Contractor shall use its best efforts to minimize costs associated with such suspension and to protect and maintain the Work. As full compensation for any such suspension, the Contractor will be eligible for an equitable adjustment, which shall not include consequential or indirect damages. Upon receipt of the Owner's notice to resume the suspended performance, the Contractor shall immediately resume performance to the extent required in the notice.

ARTICLE 19 DISPUTE RESOLUTION

19.1 All claims, disputes and other matters in question of the Contractor, direct or indirect, arising out of, or relating to, the Contract Documents or the breach thereof ("Claims") shall be decided exclusively by the following dispute resolution procedure. Failure to comply with the requirements of this Article 19 shall constitute waiver of the Claim.

19.2 Notice of Claim. The Contractor shall submit notice of all Claims to the Owner in writing within *seven (7) days* of the event giving rise to them and shall include a reasonable description of the event and its probable effect.

19.3 Claim Submission. Within *thirty (30) days* of the effective date of submitting the notice in Paragraph 19.2, the Contractor shall provide the Owner with a written Claim that includes a clear description of the Claim, all changes in cost and in time (direct, indirect, impact, consequential, and otherwise) to which the Contractor and Subcontractors of any tier are entitled, and data supporting the Claim. No act, omission, or knowledge, actual or constructive, of the Owner or any Architect shall in any way be deemed to be a waiver of the requirement for a timely written notice and a timely written Claim unless the Owner and the Contractor sign an explicit, unequivocal written waiver.

19.4 Effective Date. Unless otherwise specified in the Contract Documents, the effective date of any notice or request given in connection with this Contract shall be the date on which it is delivered to the Owner.

19.5 Informal Resolution. The Owner will make a determination of the Claim submitted. If the Contractor disagrees with the determination and wishes to pursue the Claim further, the Contractor must, within *fourteen (14) days* of receipt of the determination, provide the Owner with a written request that a representative of the Contractor, any Architect, and the Owner meet, confer, and attempt to resolve the claim. This meeting will then take place at mutually convenient time and place within *fourteen (14) days* of the Contractor's request.

19.6 Mediation. The Contractor may not bring any litigation against the Owner unless the Claim is first subject to mediation under the Construction Industry Mediation Procedures of the American Arbitration Association ("AAA"). This requirement cannot be waived except by an explicit written waiver signed by the Owner and the Contractor. To initiate the mediation process, the Contractor shall submit a written mediation request to the Owner within thirty (30) days after the meeting undertaken in Paragraph 19.5. If the parties are unable to agree to a mediator within *thirty (30) days* after the Owner's receipt of the written request for mediation, either party may submit a request for mediation to the AAA. An officer of the Contractor and the General Manager or designee of the Owner, both having full authority to settle the Claim, must attend the mediation session. To the extent there are other parties in interest, such as Subcontractors and insurers, their representatives, with full authority to settle the Claim, shall also attend the mediation session. All unresolved Claims in the Project shall be considered at a single mediation session that shall occur prior to Final Acceptance by Owner.

19.7 Litigation. The provisions of Paragraphs 19.1, 19.2, 19.5, and 19.6 are each a condition precedent to the Contractor bringing litigation. All unresolved Claims of the Contractor shall be waived and released unless the Contractor has strictly complied with the time limits of the Contract Documents, and litigation is served and filed within *120 days* after the Date of Substantial Completion as designated in writing by the Owner. This requirement cannot be waived except by an explicit written waiver signed by the Owner and the Contractor. The pendency of mediation shall toll this filing requirement.

19.8 Maintenance of Responsibilities. The parties shall diligently carry on their respective obligations and responsibilities and maintain the Progress Schedule during any dispute resolution proceedings, unless otherwise agreed by both parties in writing.

19.9 Waiver. The requirements of this Article 19 cannot be waived except by an explicit written waiver signed by the Owner and the Contractor. The fact that the Owner and the Contractor may continue to discuss or negotiate a Claim that has or may have been defective or untimely under the Contract Documents shall not constitute waiver of the provisions of the Contract Documents unless the Owner and Contractor sign an explicit, unequivocal written waiver approved by the Owner's Board of Commissioners.

SAMPLE

Supplemental Conditions

1. Payments will be in one lump sum, minus retained funds. The District may consider payments in increments of not less than twenty-five percent (25%) of contracted amount. The Contracting Officer will be the final arbiter to set the percentage of work completed for release of any payments.

1. **Progress Payments.** Progress payments shall be made monthly for Work that is duly approved and performed during the calendar month preceding the Application for Payment according to the following procedure.

- 1.1 **Schedule of Values.** Prior to submitting its first Application for Payment, the Contractor shall submit to the Owner a schedule of values allocating the Contract Sum to the various portions that comprise the Work. The schedule of values shall be prepared in such form and supported by such data as the Owner may require. The schedule of values shall allocate at least three percent (3%) of the original Contract Sum to that portion of the Work between Substantial Completion of the Work and Final Completion, which will be earned upon Final Completion and distributed in the final payment.

- 1.2 **Draft Application.** Within the first *seven (7) days* of each month, the Contractor shall submit to the Owner a report on the current status of the Work as compared to the Progress Schedule and a draft, itemized Application for Payment for Work performed through the prior calendar month. This shall not constitute a payment request. The Contractor, the Owner and the Architect or Engineer (if any) shall meet within the next *seven (7) days* and confer regarding the current progress of the Work and the amount of payment to which the Contractor is entitled. The Owner may request the Contractor to provide data substantiating the Contractor's right to payment, such as copies of requisitions or invoices from Subcontractors. The Contractor shall not be entitled to make a payment request, nor is any payment due the Contractor, until such data is furnished.

- 1.3 **Payment Request.** Within *seven (7) days* after the Contractor and the Owner have met and conferred regarding the draft Application for Payment and the Contractor has furnished all data requested, the Contractor may submit a payment request in the agreed-upon amount, in the form of a notarized, itemized Application for Payment for Work performed during the prior calendar month on a form supplied or approved by the Owner. Among other things, the Application shall state that prevailing wages have been paid in accordance with the pre-filed statement(s) of intent to pay prevailing wages on file with the Owner and that all payments due Subcontractors from the Owner's prior payments have been made. The Application shall constitute the Contractor's representation that (1) all payments due Subcontractors from the Owner's prior payments have been made and (2) the Work is current on the Progress Schedule, unless otherwise noted on the Application. If the Contractor believes it is entitled to payment for Work performed during the prior calendar month in addition to the agreed-upon amount, the Contractor may, within the same time period, submit to the Owner a separate written payment request specifying the exact additional amount due, the category in the schedule of values in which the payment is due, the specific Work for which the additional amount is due, and why the additional payment is due.

- 1.4 **Payments to Subcontractors.** No payment request shall include amounts the Contractor does not intend to pay to a Subcontractor. If, after making a request for payment but before paying a Subcontractor for its performance covered by the payment request, the Contractor discovers that part or all of the payment otherwise due to the Subcontractor is subject to withholding from the Subcontractor for unsatisfactory performance, the Contractor may withhold the amount as allowed under the subcontract, but it shall give the Subcontractor and the Owner written notice of the remedial actions that must be taken as soon as practicable after determining the cause for the withholding but before the due date for the Subcontractor payment, and pay the Subcontractor within *eight (8) working days* after the Subcontractor satisfactorily completes the remedial action identified in the notice.

- 1.5 **Retainage.** Pursuant to RCW 60.28, the Owner will reserve five percent (5%) from the moneys the Contractor earns on estimates during the progress of the Work, to be retained as a trust fund for the protection and payment of the claims of any person arising under this Contract and the state with respect to taxes imposed pursuant to Title 82 RCW, which may be due from the Contractor. The moneys reserved will be retained in a fund by the Owner until *forty-five (45) days* following formal acceptance of the Project by the Owner ("Final Acceptance"). The Contractor may retain payment of not more than five percent (5%) from the moneys earned by any Subcontractor.

- 1.6 Upon completion of the Work, Contractor shall submit a Request for Final Payment, Certificate and Release form and itemized invoice to the Owner for approval and payment.

Scope of Work- Exhibit A

SAMPLE

List of Drawings and Specifications- Exhibit B

SAMPLE

PUBLIC WORKS PERFORMANCE BOND
to MASON COUNTY PUD NO. 1, WA

Bond No. _____

The **MASON COUNTY PUD NO. 1**, Washington, (County) has awarded to _____ (Principal), a contract for the construction of the project designated as Vuecrest Reservoir and Booster Station in Shelton, Washington (Contract), and said Principal is required under the terms of that Contract to furnish a bond for performance of all obligations under the Contract.

The Principal, and _____ (Surety), a corporation organized under the laws of the State of _____ and licensed to do business in the State of Washington as surety and named in the current list of "Surety Companies Acceptable in Federal Bonds" as published in the Federal Register by the Audit Staff Bureau of Accounts, U.S. Treasury Dept., are jointly and severally held and firmly bound to the County, in the sum of _____ US Dollars (\$ _____ amount to include sales tax) Total Contract Amount, subject to the provisions herein.

This statutory performance bond shall become null and void, if and when the Principal, its heirs, executors, administrators, successors, or assigns shall well and faithfully perform all of the Principal's obligations under the Contract and fulfill all the terms and conditions of all duly authorized modifications, additions, and changes to said Contract that may hereafter be made, at the time and in the manner therein specified; and if such performance obligations have not been fulfilled, this bond shall remain in full force and effect.

The Surety agrees to indemnify, defend, and protect the County against any claim of direct or indirect loss resulting from the failure of the Principal, its heirs, executors, administrators, successors, or assigns (or any of the employees, subcontractors, or lower tier subcontractors of the Principal) to faithfully perform the Contract.

The Surety for value received agrees that no change, extension of time, alteration or addition to the terms of the Contract, the specifications accompanying the Contract, or to the work to be performed under the Contract shall in any way affect its obligation on this bond, and waives notice of any change, extension of time, alteration or addition to the terms of the Contract or the work performed. The Surety agrees that modifications and changes to the terms and conditions of the Contract that increase the total amount to be paid the Principal shall automatically increase the obligation of the Surety on this bond and notice to Surety is not required for such increased obligation.

This bond may be executed in two (2) original counterparts, and shall be signed by the parties' duly authorized officers. This bond will only be accepted if it is accompanied by a fully executed and original power of attorney for the officer executing on behalf of the surety.

The Surety agrees to be bound by the laws of the state of Washington and subjected to the jurisdiction of the state of Washington.

PRINCIPAL

SURETY

Principal Signature _____ Date _____

Surety Signature _____ Date _____

Printed Name _____

Printed Name _____

Title _____

Title _____

Local office/agent of Surety Company:

Name _____

Telephone _____

Address _____

PUBLIC WORKS PAYMENT BOND
to MASON COUNTY PUD NO. 1, WA

Bond No. _____

The **MASON COUNTY PUD NO. 1**, Washington, (County) has awarded to _____ (Principal), a contract for the construction of the project designated as Vuecrest Reservoir and Booster Station in Shelton, Washington (Contract), and said Principal is required under the terms of that Contract to furnish a payment bond in accord with Title 39.08 Revised Code of Washington (RCW) and (where applicable) 60.28 RCW.

The Principal, and _____ (Surety), a corporation organized under the laws of the State of _____ and licensed to do business in the State of Washington as surety and named in the current list of "Surety Companies Acceptable in Federal Bonds" as published in the Federal Register by the Audit Staff Bureau of Accounts, U.S. Treasury Dept., are jointly and severally held and firmly bound to the County, in the sum of _____ US Dollars (\$ _____ amount to include sales tax) Total Contract Amount, subject to the provisions herein.

This statutory payment bond shall become null and void, if and when the Principal, its heirs, executors, administrators, successors, or assigns shall pay all persons in accordance with RCW Titles 60.28, 39.08, and 39.12 including all workers, laborers, mechanics, subcontractors, lower tier subcontractors, and material suppliers, and all persons who shall supply such contractor or subcontractor with provisions and supplies for the carrying on of such work, and all taxes incurred on said Contract under Title 50 and 51 RCW and all taxes imposed on the Principal under Title 82 RCW; and if such payment obligations have not been fulfilled, this bond shall remain in full force and effect.

The Surety agrees to indemnify, defend, and protect the County against any claim of direct or indirect loss resulting from the failure of the Principal, its heirs, executors, administrators, successors, or assigns, (or the subcontractors or lower tier subcontractors of the Principal) to pay all laborers, mechanics, subcontractors, lower tier subcontractors materialpersons, and all persons who shall supply such contractor or subcontractors with provisions and supplies for the carrying on of such work.

The Surety for value received agrees that no change, extension of time, alteration or addition to the terms of the Contract, the specifications accompanying the Contract, or to the work to be performed under the Contract shall in any way affect its obligation on this bond, except as provided herein, and waives notice of any change, extension of time, alteration or addition to the terms of the Contract or the work performed. The Surety agrees that modifications and changes to the terms and conditions of the Contract that increase the total amount to be paid the Principal shall automatically increase the obligation of the Surety on this bond and notice to Surety is not required for such increased obligation.

This bond may be executed in two (2) original counterparts, and shall be signed by the parties' duly authorized officers. This bond will only be accepted if it is accompanied by a fully executed and original power of attorney for the officer executing on behalf of the surety.

The Surety agrees to be bound by the laws of the state of Washington and subjected to the jurisdiction of the state of Washington.

PRINCIPAL

SURETY

Principal Signature _____

Date _____

Surety Signature _____

Date _____

Printed Name _____

Printed Name _____

Title _____

Title _____

Local office/agent of Surety Company:

Name _____

Telephone _____

Address _____

PART 3

GENERAL CONDITIONS

GENERAL CONDITIONS

<u>TABLE OF CONTENTS</u>	<u>PAGE</u>
SECTION 1 - GENERAL INFORMATION APPLICABLE TO PROPOSAL AND CONTRACT.....	1-1
1.01 DEFINITIONS AND TERMINOLOGY	1-1
1.02 ABBREVIATIONS AND TERMINOLOGY	1-1
1.02.1 REFERENCED STANDARDS AND CODES.....	1-1
1.02.2 TERMINOLOGY	1-3
1.02.3 ITEMS OF WORK AND UNITS OF MEASUREMENT	1-3
1.03 DEFINITIONS	1-4
SECTION 2 - INSTRUCTIONS FOR PREPARATION OF PROPOSAL (OR BID)	2-1
2.01 BID PROCEDURES AND CONDITIONS.....	2-1
2.01.1 QUALIFICATIONS OF BIDDERS	2-1
2.01.2 CONTRACT PROVISIONS AND CONTRACT PLANS.....	2-1
2.01.3 ESTIMATED QUANTITIES	2-1
2.01.4 EXAMINATION OF CONTRACT AND SITE	2-1
2.01.4(1) <u>General</u>	2-1
2.01.4(2) <u>Interpretation of the Contract Provisions and Contract Plans</u>	2-2
2.01.4(3) <u>Subsurface Information</u>	2-2
2.01.4(4) <u>Availability of Specified Items</u>	2-3
2.01.5 PROPOSAL DEPOSIT	2-3
2.01.6 PROPOSAL.....	2-3
2.01.7 WITHDRAWING OR REVISING PROPOSAL	2-4
2.01.8 DISQUALIFICATION OF BIDDERS	2-5
2.01.9 PROPOSAL ERRORS	2-9
2.02 AWARD AND EXECUTION OF CONTRACT	2-10
2.02.1 AWARD OF CONTRACT	2-10
2.02.2 EXECUTION OF CONTRACT	2-10
2.02.3 FAILURE TO EXECUTE CONTRACT	2-11
2.02.4 RETURN OF BID DEPOSIT	2-11
2.02.5 NOTICE TO PROCEED	2-11
SECTION 3 - GENERAL REQUIREMENTS OF THE CONTRACT.....	3-1
3.01 SCOPE OF THE WORK.....	3-1
3.01.1 INTENT OF THE CONTRACT	3-1
3.01.2 COORDINATION OF CONTRACT.....	3-1
3.01.3 ASSIGNMENT OF CONTRACT	3-1
3.02 CONTROL OF WORK.....	3-2
3.02.1 AUTHORITY AND ROLE OF THE ENGINEER	3-2
3.02.2 AUTHORITY OF FIELD REPRESENTATIVE	3-3
3.02.3 CONSTRUCTION OBSERVATION AND INSPECTIONS	3-4
3.02.4 EMERGENCY CONTACT LIST.....	3-5
3.02.5 ORAL AGREEMENTS.....	3-5
3.02.6 ELECTRONIC FILES	3-5

3.03	LEGAL RELATIONS AND RESPONSIBILITIES	3-5
3.03.1	APPLICABLE LAWS AND REGULATIONS	3-5
3.03.1(1)	<u>General</u>	3-5
3.03.1(2)	<u>Utilities and Similar Facilities</u>	3-6
3.03.1(3)	<u>Site Maintenance</u>	3-6
3.03.1(4)	<u>State Taxes</u>	3-6
3.03.1(5)	<u>Equal Employment Responsibilities</u>	3-8
3.03.1(6)	<u>Archaeological and Historical Objects</u>	3-8
3.03.2	SAFETY MEASURES	3-8
3.03.3	HAZARDOUS MATERIAL	3-9
3.03.4	PAYMENT OF WAGES AND RELATED REQUIREMENTS	3-9
3.03.4(1)	<u>Minimum Prevailing Wage Requirements</u>	3-9
3.03.4(2)	<u>Posting Notice Requirements</u>	3-10
3.03.4(3)	<u>Apprentices</u>	3-11
3.03.4(4)	<u>Required Documents</u>	3-11
3.03.5	BONDS, INSURANCE AND INDEMNITY OBLIGATIONS	3-12
3.03.5(1)	<u>Contract Bonds</u>	3-12
3.03.5(1.1)	Two-Year Guarantee Period.....	3-13
3.03.5(2)	<u>Worker's Benefits</u>	3-13
3.03.5(4)	<u>Public Liability & Property Damage Insurance</u>	3-14
3.03.5(4.1)	General Requirements	3-14
3.03.5(4.2)	Additional Insured.....	3-15
3.03.5(4.3)	Subcontractors	3-15
3.03.5(4.4)	Verification of Coverage	3-15
3.03.5(4.5)	Coverages and Limits.....	3-16
3.03.5(4.5)A	Commercial General Liability	3-16
3.03.5(4.5)B	Automobile Liability	3-16
3.03.5(4.5)C	Workers' Compensation.....	3-17
3.03.5(4.5)D	Excess or Umbrella Liability	3-17
3.03.5(4.5)I	Marine Pollution	3-17
3.03.5(4.5)J	Pollution Liability	3-17
3.03.5(4.5)K	Professional Liability	3-18
3.03.5(5)	<u>Indemnity and Hold Harmless</u>	3-18
3.03.5(6)	<u>Patent Royalties & Process Fees</u>	3-19
3.03.6	METHOD OF SERVING NOTICE.....	3-19
3.04	PROSECUTION AND PROGRESS OF THE WORK.....	3-19
3.04.1	QUALITY OF WORK	3-19
3.04.1(1)	<u>Workmanship</u>	3-19
3.04.1(2)	<u>Contractor's Supervisory and Site Personnel</u>	3-20
3.04.2	MATERIALS AND EQUIPMENT	3-20
3.04.3	SPECIFICATION OF PARTICULAR MATERIALS AND EQUIPMENT ...	3-21
3.04.4	STORAGE.....	3-21
3.04.4(1)	<u>On-Site Storage</u>	3-21
3.04.4(2)	<u>Off-Site Storage</u>	3-22
3.04.5	DEFECTIVE MATERIALS, EQUIPMENT AND WORKMANSHIP	3-22
3.04.6	CHANGES IN THE WORK	3-23

3.04.7	DIFFERING SITE CONDITIONS	3-27
3.04.8	PROTEST BY THE CONTRACTOR	3-28
3.04.9	SUBCONTRACTORS AND SUBCONTRACTS	3-29
3.04.9(1)	<u>Contractor Responsibility</u>	3-29
3.04.9(2)	<u>Contractor Work Performance Requirement</u>	3-29
3.04.9(3)	<u>Approval of Subcontractors</u>	3-30
3.04.9(4)	<u>Subcontracts</u>	3-30
3.04.9(5)	<u>Incorporation of Contract</u>	3-30
3.04.9(6)	<u>Replacement of Subcontractors</u>	3-30
3.04.10	MUTUAL RESPONSIBILITY OF CONTRACTORS	3-30
3.04.11	RISK OF LOSS	3-31
3.04.12	MEASUREMENT AND PAYMENT	3-31
3.04.12(1)	<u>General</u>	3-31
3.04.12(2)	<u>Measurement</u>	3-31
3.04.12(3)	<u>Payment</u>	3-31
3.04.12(4)	<u>Access to Books and Records</u>	3-31
3.04.12(5)	<u>Progress Payment Estimates</u>	3-32
3.04.12(6)	<u>Payment for Materials on Hand</u>	3-32
3.04.12(7)	<u>Payments Withheld</u>	3-32
3.04.12(8)	<u>Payment Upon Correction of Deficiencies</u>	3-33
3.04.12(9)	<u>Final Payment</u>	3-33
3.04.13	WORK HOURS	3-34
3.04.14	CONTRACT TIME	3-34
3.04.15	CONSTRUCTION SCHEDULE	3-34
3.04.15(1)	<u>Progress Schedule</u>	3-34
3.04.15(2)	<u>Extensions of the Contract Time</u>	3-36
3.04.15(3)	<u>Liquidated Damages</u>	3-37
3.04.16	COMPLETION AND ACCEPTANCE OF THE WORK	3-37
3.04.16(1)	<u>Substantial Completion Date</u>	3-37
3.04.16(2)	<u>Physical Completion Date</u>	3-38
3.04.16(3)	<u>Contract Completion Date (Acceptance of the Project)</u>	3-39
3.04.16(4)	<u>Use of Completed Portions of the Work</u>	3-40
3.04.16(5)	<u>Waiver of Claims by Contractor</u>	3-40
3.04.17	CORRECTION OF FAULTY WORK AFTER FINAL PAYMENT	3-40
3.04.18	RETAINAGE	3-40
3.05	DISPUTES AND CLAIMS	3-42
3.05.1	DISPUTES	3-42
3.05.2	CLAIMS	3-42
3.05.3	TIMELINE AND JURISDICTION	3-45
3.05.4	CONTINUATION OF WORK PENDING RESOLUTION OF DISPUTES ...	3-45
3.06	NOT USED	3-45
3.07	SUSPENSION OF WORK AND TERMINATION OF CONTRACT	3-46
3.07.1	SUSPENSION OF WORK	3-46
3.07.2	TERMINATION FOR DEFAULT	3-46
3.07.3	TERMINATION FOR CONVENIENCE OF THE OWNER	3-47
3.07.4	RESPONSIBILITY OF THE CONTRACTOR AND SURETY	3-47

GENERAL CONDITIONS

SECTION 1 - GENERAL INFORMATION APPLICABLE TO PROPOSAL AND CONTRACT

1.01 DEFINITIONS AND TERMINOLOGY

The following terms are abbreviated and defined as they are used in the Contract. When used in the Proposal form to denote items of Work and units of measurements, abbreviations mean the full expression of the abbreviated term.

1.02 ABBREVIATIONS AND TERMINOLOGY

1.02.1 REFERENCED STANDARDS AND CODES

The following is a partial list of specifications and codes that may be referenced in sections of the Contract. The Contractor shall be responsible for conducting its Work and carrying out its operations and furnishing equipment in accordance with the latest edition or versions, in effect at the time of bid opening, of any applicable specified portions of the referenced standards and codes.

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AFBMA	Anti-friction Bearing Manufacturing Association
AGA	American Gas Association
AGC	Associated General Contractors of America
AI	Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association
ANLA	American Nursery and Landscape Association
ANSI	American National Standards Institute, Inc.
APA	American Plywood Association
API	American Petroleum Institute
APWA	American Public Works Association
ARA	American Railway Association
AREMA	American Railway Engineering and Maintenance-of-Way Association
ASA	American Standards Association
ASCE	American Society of Civil Engineers
ASLA	American Society of Landscape Architects
ASME	American Society Mechanical Engineers
ASNT	American Society for Nondestructive Testing
ASTM	American Society for Testing and Material
AWPA	American Wood Preservers' Association
AWS	American Welding Society

AWWA	American Water Works Association
CFR	Code of Federal Regulations
CLI	Chain Link Institute
CRAB	County Road Administration Board
CRSI	Concrete Reinforcing Steel Institute
CSA	Canadian Standards Associations
CSI	Construction Specifications Institute
DIPRA	Ductile Iron Pipe Research Association
EEI	Edison Electric Institute
EPA	Environmental Protection Agency
ETL	Electrical Testing Laboratories
FHWA	Federal Highway Administration
FM	Factory Mutual
FSS	Federal Specifications and Standards, General Services Administration
HUD	United State Department of Housing and Urban Development
IBC	International Building Code
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronic Engineers
IES	Illumination Engineering Society
IMSA	International Municipal Signal Association
IPC	International Plumbing Code
ISA	Instrumentation Society of America
JIC	Joint Industry Conference Electrical Standards for Industrial Equipment
LID	Local Improvement District
LPI	Lightning Protection Institute
MSHA	Mine Safety and Health Act
MSS	Manufacturer's Standardization Society of the Valve and Fitting Industry
MUTCD	Manual on Uniform Traffic Control Devices
NCMA	National Concrete Manufacturer's Association
NEC	National Electrical Code
NEMA	National Electrical Manufacturers' Association
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
NRMCA	National Ready Mix Concrete Association
OMWBE	Office of Minority and Women's Business Enterprises
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PPI	Plastic Pipe Institute
P/PCI	Precast/Prestressed Concrete Institute
RCW	Revised Code of Washington
SAE	Society of Automotive Engineers
SEPA	State Environmental Policy Act
SIES	Specifications and Illuminating Engineering Society
SSPC	Steel Structures Painting Council
UL	Underwriters' Laboratory
ULID	Utility Local Improvement District
UMTA	Urban Mass Transit Administration

WABO	Washington Association of Building Officials
WAC	Washington Administrative Code
WCLIB	West Coast Lumber Inspection Bureau
WISHA	Washington Industrial Safety and Health Administration
WRI	Wire Reinforcement Institute
WSDL&I	Washington State Department of Labor and Industries
WSDOE	Washington State Department of Ecology
WSDOT	Washington State Department of Transportation
WWPA	Western Wood Products Association

1.02.2 TERMINOLOGY

The use of pronouns of any gender in these General Conditions shall include pronouns of all genders, as applicable.

The terms “provide,” “furnish” and “install” are used interchangeably in the Contract and mean that the Contractor shall provide, furnish, and install the item(s) described unless specifically noted otherwise.

The terms “Plans” and “Drawings” are used interchangeably in the Contract and shall mean the Contract Plans, which show location, character, and dimensions of prescribed Work, including layouts, profiles, cross-sections, and other details.

1.02.3 ITEMS OF WORK AND UNITS OF MEASUREMENT

AC	Asbestos Cement Pipe
Agg.	Aggregate
Al.	Aluminum
ATB	Asphalt Treated Base
BST	Bituminous Surface Treatment
CB	Catch Basin
Cfm	Cubic Feet per Minute
Cfs	Cubic Feet per Second
Cl.	Class
CMP	Corrugated Metal Pipe
Comb.	Combination
Conc.	Concrete
CPEP	Corrugated Polyethylene Pipe
Crib.	Cribbing
Culv.	Culvert
Cy or Cu. Yd.	Cubic Yard(s)
Dia.	Diameter
DI	Ductile Iron
DIM	Dimension
EA	Each
EL	Elevation
Est.	Estimate or Estimated

Excl.	Excluding
F	Fahrenheit
FIG	Figure
Ft.	Foot or Feet
GALV	Galvanized
Gph	Gallon(s) per Hour
Gpm	Gallon(s) per Minute
HDPE	High Density Polyethylene
HMA	Hot Mix Asphalt
HR	Hour
Hund.	Hundred
In.	Inch or Inches
Incl.	Including
L	Liter
Lb.	Pound(s)
LF or Lin. Ft.	Linear Foot (Feet)
LS	Lump Sum
M	Thousand
MBM	Thousand Feet Board Measure
Pres.	Pressure
PSI	Pounds per Square Inch
PSF	Pounds per Square Foot
PVC	Polyvinyl Chloride
QTY	Quantity
Reg.	Regulator
Reinf.	Reinforced, Reinforcing
SF	Square Foot (Feet)
Sec.	Section
SL	Slope
St.	Street
Stl.	Steel
SST	Stainless Steel
Str.	Structural
Sy or Sq. Yd.	Square Yard(s)
Th.	Thick or Thickness
TN	Ton
Tr.	Treatment
TYP	Typical
VC	Vitrified Clay

1.03 DEFINITIONS

ACCEPTANCE

The formal action by Owner or Owner's governing body as provided in RCW 39.08 and RCW 60.28.

ADDENDUM

A written or graphic document issued to all Bidders prior to bid opening and identified as an addendum, which clarifies, modifies or supplements the bid documents and becomes part of the Contract.

ADDITIVE

A supplemental unit of work or group of bid items, identified separately in the Proposal, which may, at the discretion of the Owner, be awarded in addition to the base bid.

ALTERNATE

One of two or more units of work or groups of bid items, identified separately in the Proposal, from which the Owner may make a choice between different methods or material of construction for performing the same work.

AWARD

The formal decision of the Owner awarding the Contract to the lowest or most favorable responsible and responsive Bidder for the Work.

BID DOCUMENTS

The component parts of the proposed Contract which may include, but not limited to, the Proposal form, the proposed Contract Provisions, the proposed Contract Plans, Addenda, and Subsurface Boring Logs (if any).

BIDDER

A natural person or legal entity (e.g., partnership, corporation, limited liability company, firm, or joint venture) submitting a proposal or bid.

BUSINESS DAY

A business day is any day from Monday through Friday, except holidays, as listed in Section 3.04.14.

CLERK

The duly elected or appointed Clerk of the Commission, Council, or Board of Directors of the Owner.

COMMISSION, COUNCIL, OR BOARD OF DIRECTORS

The duly elected or appointed Council, Commission, or Board of Directors of the Owner.

CONTRACT

The written agreement between the Owner and the Contractor. It describes, among other things:

1. What work will be done, and by when;
2. Who will provide labor and materials; and
3. How Contractor will be paid.

The Contract includes: the agreement form, Bidder's completed Proposal form, all required certificates and affidavits, Performance Bond and Public Works Payment Bond, Contract Provisions, Contract Plans, Standard Plans, and all Addenda and Change Orders executed pursuant to the provisions of the Contract.

CONTRACT BOND

The approved form of security furnished by the Contractor and the Contractor's Surety as required by the Contract, that guarantees performance of all the Work required by the Contract and payment to anyone who provides supplies or labor for the performance of the Work.

CONTRACT DOCUMENTS

See definition for "Contract."

CONTRACT PLANS (PLANS OR DRAWINGS)

The Contract Plans (or drawings) are those plans, drawings or other illustrations and all addenda and revisions, whether issued before or after the award of the contract to Contractor, which show location, character, and dimensions of the Work, including layouts, profiles, cross-sections and other details.

CONTRACT PROVISIONS

A publication addressing the work required for an individual project. At the time of the call for bids, the contract provisions may include, for a specific individual project, general conditions, supplemental general conditions, specifications, a listing of the applicable standard plans, the prevailing minimum hourly wage rates, and an informational proposal form with the listing of bid items. The proposed contract provisions may also include, for a specific individual project, various required certifications or declarations. At the time of the contract execution date, the contract provisions include the proposed contract provisions and include any addenda, a copy of the agreement form, and a copy of the proposal form with the contract prices and extensions.

CONTRACT TIME

Contract time shall mean the number of calendar days stated in the Contract for completion of work or specified portions thereof.

CONTRACTOR

The natural person(s) or legal entity (e.g., partnership, corporation, limited liability company, firm, joint venture) awarded the contract to perform the Work pursuant to the Contract Documents.

DATES

Substantial Completion Date is the day that the Engineer determines the Owner has full and unrestricted use and benefit of the Work, from both an operational and safety standpoint, any remaining traffic disruptions will be rare and brief, and only minor incidental work, replacement of temporary substitute facilities, plant establishment periods, or correction or repair remains for the physical completion of the total Work.

Physical Completion Date is the day that the Engineer determines that all of the Work required by the Contract is physically completed and the Owner has received from the Contractor all required record drawings, operation and maintenance manuals, manufacturers' affidavits, and software and programming.

Contract Completion Date is the day when all the Work and all the obligations of the Contractor under the Contract are fulfilled by the Contractor. All documentation and other items required by the Contract and required by law shall be furnished by the Contractor before establishment of this date.

Final Acceptance Date is the date on which the Owner accepts the work as complete.

FIELD REPRESENTATIVE

The Owner's representative who observes the Contractor's performance of the Work. Such observation shall not be relied upon by the Contractor or others as approval or acceptance of the Work, nor shall it in any manner relieve the Contractor from its obligations and responsibilities under the Contract.

NOTICE TO PROCEED

The written notice from the Owner or Engineer to the Contractor authorizing and directing the Contractor to proceed with the Work and establishing the date on which the Contract Time begins.

OWNER

The government entity or agency that awards the contract to the Contractor and is responsible for the execution and administration of the Contract.

PROJECT ENGINEER/ENGINEER

The Owner's staff or representative who administers the construction program for the Owner.

PROPOSAL (or BID)

A Bidder's offer, on a properly completed Proposal form, to perform the Work required by the Contract. The terms Proposal and Bid may be used interchangeably.

SPECIFICATIONS

Written provisions describing the Work and requirements thereof.

STANDARD PLANS

A manual of specific plans or drawings adopted by the Owner, which show frequently recurring components of work that, have been standardized for use.

SUBCONTRACTOR

A natural person, or entity (e.g., partnership, corporation, limited liability company, firm or joint venture) to which the Contractor sublets a portion of the Work.

SUBGRADE

The top surface of the roadbed on which subbase, base, surfacing, pavement, or layers of similar materials are placed.

SUPPLEMENTARY GENERAL CONDITIONS

That part of the Contract amends or supplements these General Conditions.

TRAVELED WAY

That part of the roadway made for vehicle travel, excluding shoulders and auxiliary lanes.

WORK

The provision of all labor, materials, tools, equipment, supervision and other things needed to complete the project in full accordance with the Contract Documents.

WORKING DRAWINGS

Shop drawings, shop plans, erection plans, falsework plans, framework plans, cofferdam, cribbing and shoring plans, bending diagrams for reinforcing steel, or any other supplementary plans or similar data, including a schedule of submittal dates for working drawings where specified, that the Contractor shall submit to the Engineer for approval.

SECTION 2 - INSTRUCTIONS FOR PREPARATION OF PROPOSAL (OR BID)

2.01 BID PROCEDURES AND CONDITIONS

2.01.1 QUALIFICATIONS OF BIDDERS

Where applicable and required, Bidders shall provide all requested information relating to experience, financing, equipment, and organization relating to their ability to properly perform the Work. The Owner reserves the right to take whatever action it deems necessary to ascertain the responsibility of the Bidder and the ability of the Bidder to perform the Work satisfactorily.

2.01.2 CONTRACT PROVISIONS AND CONTRACT PLANS

Contract Provisions and Contract Plans are on file in the offices of the Owner and the Engineer, Gray & Osborne, Inc. After award of the Contract, five sets of Contracts will be issued without charge to the Contractor. Additional sets of Contracts may be purchased from the Owner by the Contractor.

2.01.3 ESTIMATED QUANTITIES

The quantities shown in the Proposal form are estimates and are stated only for bid comparison purposes. The Owner does not warrant, expressly or by implication, that the actual quantities will correspond with those estimates. Payment will be made on the basis of the actual quantities of each item of Work satisfactorily completed in accordance with the requirements of the Contract.

2.01.4 EXAMINATION OF CONTRACT AND SITE

2.01.4(1) General

Bidders shall satisfy themselves by personal examination of Contract Provisions, Contract Plans, and site of the proposed improvements, and by any other examination and investigation which they may desire to make as to the accuracy of the estimate of quantities, the nature of the Work and the difficulties to be encountered. Bidders shall review the entire Contract to ensure that the completeness of their Proposal includes all items of Work regardless of where shown in the Contract. Bidders are cautioned that alternate sources of information (copies of the Contract obtained from third parties) are not necessarily an accurate or complete representation of the Contract. Bidders shall use such information at their own risk.

Bidders shall be familiar and comply with all applicable federal, state, and local laws, ordinances, and regulations in any way applicable to the performance the Work. Bidders are responsible for familiarizing themselves with all current state wage rates applicable to the Work and its duration before submitting a Proposal based on the Contract Provisions and Contract Plans. Any wage determination contained in the Contract is for the Bidder's general information only and is not warranted to be complete or accurate. The Owner will not consider any plea of misunderstanding or ignorance of such requirements. Bid prices shall reflect what the Bidder has determined to be the total cost of completing the Work, including but not limited to: construction methods, materials, labor, administrative costs, any and all applicable taxes, and equipment. Except as the

Contract may provide, the Bidder to which the contract is awarded shall receive no payment for any costs that exceed those set forth in the Proposal.

2.01.4(2) Interpretation of the Contract Provisions and Contract Plans

If any Bidder desires interpretation or clarification of the Contract Provisions and Contract Plans, the Bidder shall make a written request to the Engineer for such clarification or interpretation prior to the submission of a Proposal. If the Engineer determines that the Contract Provisions and/or Contract Plans do not require interpretation or clarification, the Engineer will so notify the Bidder making the request. All interpretations and clarifications made by the Engineer will be by written addendum to all planholders of record, and a copy of the addendum will be filed in the office of the Owner. Neither the Owner nor the Engineer will be responsible for any interpretation, clarification or explanation of the Contract Provisions and Contract Plans that is not set forth in a written addendum to all planholders of record, and Bidders shall not under any circumstances rely on any other interpretation, clarification or explanation.

2.01.4(3) Subsurface Information

If the Owner has made a subsurface investigation of the site of the proposed Work, the boring log data and soil sample test data accumulated by the Owner will be made available for inspection by the Bidders. However, the Owner makes no representation or warranty, express or implied, that:

- a. The Bidders' interpretations from the boring logs may be correct;
- b. Moisture conditions and indicated water tables will not vary from those found at the time the borings were made;
- c. The ground at the location of the borings has not been physically disturbed or altered after the boring was made; and
- d. Conditions below the surface of the ground are consistent throughout the site with the information made available hereunder, or that conditions to be encountered on the site are uniform or consistent with geological conditions usually encountered in the area.

The Owner makes no representations, guarantees, or warranties as to the condition, materials, or proportions of the materials between the specific borings, regardless of any subsurface information the Owner may make available to the prospective Bidders. Bidders are solely responsible for making the necessary investigations to support and/or verify any conclusions or assumptions used in preparation of their Proposals.

Any subsurface investigations and analysis were carried out for design purposes only. Contractor may not rely upon or make any claim against Owner, Engineer, or any of their subconsultants, with respect to:

1. The completeness of such reports for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and

procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or

2. Other conclusions, interpretations, opinions, representations, and information contained in such reports; or
3. Any Contractor interpretation of or conclusion drawn from any “technical data” or any such other data, conclusions, interpretations, opinions or information.

2.01.4(4) Availability of Specified Items

Prior to submitting a Proposal, all Bidders shall verify that all items necessary to complete the Work will be available in time to allow the Work to be completed within the Contract Time. In the event that one or more items may not be available to allow the Work to be completed within the Contract Time, the Bidder shall notify the Engineer in writing prior to submitting a Proposal. Responsibility for delays and related costs because of non-availability of items necessary to complete the Work shall be borne by the Contractor.

2.01.5 PROPOSAL DEPOSIT

A deposit of at least 5 percent of the total Proposal amount shall accompany each Proposal. This deposit may be in the form of a Proposal bond (surety bond), certified check, cashier’s check, or postal money order made payable to the Owner. All Proposal bonds shall be on the form included within the Contract Provisions and shall be signed by the Bidder and the surety. The surety shall: (1) be registered with the Washington State Commissioner, and (2) appear on the current Authorized Insurance List in the State of Washington published by the Office of the Insurance Commissioner. The Proposal bond shall not be conditioned in any way to modify the minimum 5 percent required. The Proposal Deposit will be held as a guaranty that the successful Bidder will, within 10 days from the date of notification of Award, enter into a Contract and furnish approved Performance and Public Works Payment Bonds, on forms attached, in amounts equal to 100 percent of the amount of the Contract, including state sales tax.

2.01.6 PROPOSAL

- (1) Proposals shall be submitted on the Proposal form included in the Contract Provisions. All Proposals shall be completed, signed by an authorized person and dated. To be considered by the Owner as a responsive Proposal, the Bidder shall bid on all Additive or Alternate items set forth in the Proposal form, unless otherwise specified in the Contract Documents.
- (2) To be responsive, a Proposal shall state that it will remain valid for a period of 60 days following the date of Proposal opening. In the event that a conflict in this duration appears elsewhere in the Contract Provisions, the longest duration shall apply.
- (3) All prices set forth on the Proposal form shall be legible and either be written in ink or typed. In the space provided on the Proposal form, Bidders shall identify all

Addenda that have been received. The Proposal, Bid bond, and all other certificates, forms or other documents required by the Contract Provisions to be executed and delivered with the Proposal shall be submitted in a sealed package, addressed to the Owner, and plainly marked "Proposal for _____ (insert name of project as shown on the Proposal) to be opened on the _____ day of _____, 20____," (insert the day, month and year shown in the published bid notice). The Owner will not consider any Proposal received after the time established for opening Proposals.

- (4) Where noted in the Proposal, the Bidder to furnish information concerning its experience with work of a similar nature, equipment to be used on this project, and general background information. Information that is incomplete, evasive, or of a general nature only, may be considered as grounds for rejection of the Proposal.
- (5) The apparent successful Bidder may be required to submit to the Engineer as soon as possible after the Proposal opening, and not later than three calendar days thereafter, a written list of all proposed Subcontractors that will perform subcontracting Work on the Project. If not previously provided, the following information shall be provided for each Subcontractor:
 - a. Name, address, email address, facsimile number, telephone number, contractor registration number and certification numbers;
 - b. The type of Work to be performed;
- (6) After opening and reading Proposals, the Owner will check them for correctness of extensions of the prices per unit and the total price. If a discrepancy exists between the price per unit and the extended amount of any bid item, the price per unit, converted to the actual extension, will control. The total extensions, corrected where necessary, will be used by the Owner for comparison and award purposes and to establish the amount of the Contractor's Performance and Public Works Payment Bonds.

2.01.7 WITHDRAWING OR REVISING PROPOSAL

After submitting a physical Proposal to the Owner, the Bidder may withdraw, or revise it if:

1. The Bidder submits a written request signed by an authorized person and physically delivers it to the place designated for receipt of Proposals; and
2. The Owner receives the request before the time set for receipt of Proposals; and
3. The revised or supplemented Proposal (if any) is received by the Owner before the time set for receipt of Proposals.

If the Bidder's request to withdraw or revise its Proposal is received before the time set for receipt of Proposals, the Owner will return the unopened Proposal package to the Bidder. The Bidder

must then submit the revised package in its entirety. If the Bidder does not submit a revised package, then its bid shall be considered withdrawn.

The District's server clock will serve as the official time clock for submittal of bid proposals.

Late revised Proposals or late withdrawal requests will be date recorded by the Owner and returned unopened. Mailed, emailed, or faxed requests to withdraw or revise a Bid Proposal are not acceptable.

2.01.8 DISQUALIFICATION OF BIDDERS

1. A proposal will be considered irregular and will be rejected if:
 - a. The authorized proposal form furnished by the Owner is not used or is altered;
 - b. The completed proposal form contains any unauthorized additions, deletions, alternate Bids, or conditions;
 - c. The Bidder adds provisions reserving the right to reject or accept the award, or enter into the Contract;
 - d. A price per unit cannot be determined from the Bid Proposal;
 - e. The Proposal form is not properly executed;
 - f. The Bidder fails to submit or properly complete a Subcontractor list, if applicable;
 - g. The Bidder fails to submit or properly complete a Disadvantaged, Minority or Women's Business Enterprise Certification, if applicable;
 - h. The Bid Proposal does not constitute a definite and unqualified offer to meet the material terms of the Bid invitation; or
 - i. More than one proposal is submitted for the same project from a Bidder under the same or different names.
2. A Proposal may be considered irregular and may be rejected if:
 - a. The Proposal does not include a unit price for every Bid item;
 - b. Any of the unit prices are excessively unbalanced (either above or below the amount of a reasonable Bid) to the potential detriment of the Owner;
 - c. Receipt of Addenda is not acknowledged;
 - d. A member of a joint venture or partnership and the joint venture or partnership submit Proposals for the same project (in such an instance, both Bids may be rejected); or
 - e. If Proposal form entries are not made in ink.
3. A Bidder will be deemed not responsible if the Bidder does not meet the mandatory bidder responsibility criteria in RCW 39.04.350(1), as amended; or does not meet Supplemental Criteria 1 through 8 in this Section:

The Owner will verify that the Bidder meets the mandatory bidder responsibility criteria in RCW 39.04.350(1), and Supplemental Criteria 1. Evidence that the

Bidder meets Supplemental Criteria 2 through 8 shall be provided by the Bidder as stated later in this Section.

a. **Criteria 1 – Federal Debarment**

1. Criterion: The Bidder shall not currently be debarred or suspended by the Federal government.
2. Documentation: The Bidder shall not be listed as having an “active exclusion” on the U.S. government’s “System for Award Management” database (www.sam.gov).

b. **Criteria 2 – Delinquent State Taxes**

1. Criterion: The Bidder shall not owe delinquent taxes to the Washington State Department of Revenue without a payment plan approved by the Department of Revenue.
2. Documentation: The Bidder shall, if and when required as detailed below, sign a statement (on a form to be provided by the Owner) that the Bidder does not owe delinquent taxes to the Department of Revenue. If the Bidder owes delinquent taxes, they must submit a written payment plan approved by the Department of Revenue, to the Owner by the deadline listed below.

c. **Criteria 3 – Claims Against Retainage and Bonds**

1. Criterion: The Bidder shall not have a record of excessive claims filed against the retainage or payment bonds for public works projects in the 3 years prior to the bid submittal date, that demonstrate a lack of effective management by the Bidder of making timely and appropriate payments to its subcontractors, suppliers, and workers, unless there are extenuating circumstances and such circumstances are deemed acceptable to the Owner.
2. Documentation: The Bidder shall, if and when required as detailed below, sign a statement (on a form to be provided by the Owner) that the Bidder has not had claims against retainage and bonds in the 3 years prior to the bid submittal date. If the Bidder has had claims against retainage and bonds in the three years prior to the bid submittal date, they shall submit a list of the public works projects completed in the 3 years prior to the bid submittal date that have had claims against retainage and bonds and include for each project the following information:
 - Name of project
 - The owner and contact information for the owner;

- A list of claims filed against the retainage and/or payment bond for any of the projects listed;
- A written explanation of the circumstances surrounding each claim and the ultimate resolution of the claim.

d. **Criteria 4 – Public Bidding Crime**

1. Criterion: The Bidder and/or its owners shall not have been convicted of a crime involving bidding on a public works contract in the 5 years prior to the bid submittal date.
2. Documentation: The Bidder, if and when required as detailed below, shall sign a statement (on a form to be provided by the Owner) that the Bidder and/or its owners have not been convicted of a crime involving bidding on a public works contract.

e. **Criteria 5 – Termination for Cause / Termination for Default**

1. Criterion: The Bidder shall not have had any public works contract terminated for cause or terminated for default by a government agency in the 5 years prior to the bid submittal date, unless there are extenuating circumstances and such circumstances are deemed acceptable to the Owner.
2. Documentation: The Bidder, if and when required as detailed below, shall sign a statement (on a form to be provided by the Owner) that the Bidder has not had any public works contract terminated for cause or terminated for default by a government agency in the 5 years prior to the bid submittal date; or if Bidder was terminated, describe the circumstances.

f. **Criteria 6 – Lawsuits**

1. Criterion: The Bidder shall not have lawsuits with judgments entered against the Bidder in the 5 years prior to the bid submittal date that demonstrate a pattern of failing to meet the terms of contracts, unless there are extenuating circumstances and such circumstances are deemed acceptable to the Owner.
2. Documentation: The Bidder, if and when required as detailed below, shall sign a statement (on a form to be provided by the Owner) that the Bidder has not had any lawsuits with judgments entered against the Bidder in the 5 years prior to the bid submittal date that demonstrate a pattern of failing to meet the terms of contracts, or shall submit a list of all lawsuits with judgments entered against the Bidder in the 5 years prior to the bid submittal date, along with a written explanation of the circumstances

surrounding each such lawsuit. The Owner shall evaluate these explanations to determine whether the lawsuits demonstrate a pattern of failing to meet terms of construction related contracts.

g. **Criteria 7 – Contract Time (Liquidated Damages)**

1. **Criterion:** The Bidder shall not have had liquidated damages assessed on any projects it has completed 5 years prior to the bid submittal date that demonstrate a pattern of failing to meet contract time, unless there are extenuating circumstances and such circumstances are deemed acceptable to the Owner.
2. **Documentation:** The Bidder, if and when required as detailed below, shall sign a statement (on a form to be provided by the Owner) that the Bidder has not had liquidated damages assessed on any projects it has completed within the 5 years prior to the bid submittal date, or shall submit a list of Projects with assessed liquidated damages along with Owner contact information, and number of days assessed liquidated damages.

h. **Criteria 8 – Capacity and Experience**

1. **Criterion:** The Bidder shall have sufficient current capacity and the project superintendent assigned to the project shall have experience to meet the requirements of this Project. The Bidder and the project superintendent shall have successfully completed at least two projects as the prime contractor, of a similar size and scope, during the 5-year period immediately preceding the bid submittal deadline for this project. Similar size is defined as a minimum of 70 percent of the bid amount submitted by the Bidder.
2. **Documentation:** The Bidder shall, if and when required as detailed below, on a form to be provided by the Owner, provide the Bidder's gross dollar amount of work currently under contract, the Bidder's gross dollar amount of contracts currently not completed, five major pieces of equipment anticipated to be on the project and whether the equipment is leased or owned, the superintendent assigned to this project and their number of years of experience, and two project references of similar size and scope during the 5-year period immediately preceding the bid submittal deadline for this project. The Owner may check owner references for the previous projects and may evaluate the owner's assessment of the Bidder performance.

As evidence that the Bidder meets Supplemental Responsibility Criteria 2 through 8 stated above, the apparent two lowest Bidders must submit to the Owner by 12:00 P.M. (noon) of the second business day following the bid submittal deadline,

a written statement verifying that the Bidder meets Supplemental Criteria 2 through 8 together with supporting documentation (sufficient in the sole judgment of the Owner) demonstrating compliance with Supplemental Responsibility Criteria 2 through 8. The Owner reserves the right to request further documentation as needed from the low bidder and documentation from other Bidders as well to assess Bidder responsibility and compliance with all bidder responsibility criteria. The Owner also reserves the right to obtain information from third-parties and independent sources of information concerning a Bidder's compliance with the mandatory and supplemental criteria, and to use that information in their evaluation. The Owner may consider mitigating factors in determining whether the Bidder complies with the requirements of the Supplemental Criteria.

The basis for evaluation of Bidder compliance with these mandatory and Supplemental Criteria shall include any documents or facts obtained by Owner (whether from the Bidder or third parties) including but not limited to: (i) financial, historical, or operational data from the Bidder; (ii) information obtained directly by the Owner from others for whom the Bidder has worked, or other public agencies or private enterprises; and (iii) any additional information obtained by the Owner which is believed to be relevant to the matter.

If the Owner determines the Bidder does not meet the bidder responsibility criteria above and is therefore not a responsible Bidder, the Owner shall notify the Bidder in writing, with the reasons for its determination. If the Bidder disagrees with this determination, it may appeal the determination within 2 business days of the Owner's determination by presenting its appeal and any additional information to the Owner. The Owner will consider the appeal and any additional information before issuing its final determination. If the final determination affirms that the Bidder is not responsible, the Owner will not execute a contract with any other Bidder until at least 2 business days after the Bidder determined to be not responsible has received the Owner's final determination.

Request to Change Supplemental Bidder Responsibility Criteria Prior To Bid: Bidders with concerns about the relevancy or restrictiveness of the Supplemental Bidder Responsibility Criteria may make or submit requests to the Owner to modify the criteria. Such requests shall be in writing, describe the nature of the concerns, and propose specific modifications to the criteria. Bidders shall submit such requests to the Owner no later than 5 business days prior to the bid submittal deadline and address the request to the Project Engineer or such other person designated by the Owner in the Bid Documents.

2.01.9 PROPOSAL ERRORS

If a Bidder discovers an error in the Bidder's Proposal after the Proposals have been opened and tabulated and desires to withdraw the erroneous Proposal, the Bidder shall submit a notarized affidavit signed by the Bidder, accompanied by original certified worksheets used in the preparation of the Proposal, requesting relief from the Award. The affidavit shall describe the

specific error(s) and certify that the worksheets are the originals used in the preparation of the Proposal.

The affidavit and the certified worksheets shall be received by the Engineer before 5:00 p.m. local time on the next business day following the day of the Proposal opening or the claim of error will not be considered. The Engineer will review the certified worksheets to determine the validity of the claimed error, and make its recommendation to the Owner. If the Owner and Engineer concur that the claim of error is allowable under applicable law, the Bidder will be relieved of responsibility for the Proposal, and the Proposal Deposit will be returned to the Bidder. Thereafter, at the discretion of the Owner, all Proposals may be rejected or an Award made to the next lowest responsive, responsible Bidder.

2.02 AWARD AND EXECUTION OF CONTRACT

2.02.1 AWARD OF CONTRACT

A Contract will not be awarded until the Owner is satisfied that the successful Bidder is responsible, reasonably familiar with the Work to be performed and has the necessary capital, tools, personnel and equipment to satisfactorily perform the Work.

The Owner reserves the right to waive informalities in the bidding, accept a Proposal of the lowest responsive, responsible Bidder, reject any or all Proposals, republish the call for Proposals, or revise or cancel the project.

After the date and hour set for the opening of the Proposals, no Bidder may withdraw its Proposal unless the Award of the Contract is delayed for a period exceeding 60 calendar days following Proposal opening. In the event that a conflicting duration appears elsewhere in the Invitation for Proposals or Contract Provisions or advertisement, the longer period shall govern.

2.02.2 EXECUTION OF CONTRACT

Within 10 calendar days after notification by the Owner of the Award, the successful Bidder shall return to the Engineer the signed Owner-prepared Contract, all insurance certificates and endorsements required by the Contract Provisions, all other certificates, information, and forms required by the Contract Provisions, and Performance and Public Works Payment Bonds required by the Contract Provisions. If the Contract is signed by an officer, agent, or other authorized representative of the Contractor, the officer, agent, or other representative shall furnish satisfactory evidence of authority to sign as the legal representative of the Contractor, if required by the Owner. An authorized partner of a joint venture may sign the Contract, subject to the approval of the Owner, which may, at its discretion, require each and every member of the joint venture to sign the Contract.

Should the successful bidder fail to return to the Engineer the signed Owner-prepared Contract, all insurance certificates and endorsements required by the Contract Provisions, all other certifications, information, and forms required by the Contract Provisions, and Performance and Public Works Payment Bonds required by the Contract Provisions within 10 calendar days after notification by the Owner of the Award, the Owner reserves the right to and may elect to withdraw

the award to the successful bidder and award the Contract to the next responsible, responsive bidder.

Until the Owner executes the Contract, no Proposal shall bind the Owner, and the Contractor shall not commence any Work. The Contractor shall bear all risks for any Work begun before the Contract is executed by the Owner.

2.02.3 FAILURE TO EXECUTE CONTRACT

If the Contractor fails to submit the insurance certificates, bonds, and all other certificates, forms, information and documents as required by the Contract Provisions, with the executed Contract within the time required by the Contract Provisions, the Owner may then award the Contract to the next lowest responsive, responsible Bidder or reject any or all Proposals.

2.02.4 RETURN OF BID DEPOSIT

When Proposals have been examined and corrected as necessary, proposal bonds and deposits accompanying Proposals ineligible for further consideration will be returned. All other Proposal bonds and deposits will be held until the Contract is awarded and fully executed, after which the Proposal bonds and deposits, except those subject to forfeiture, will be returned.

2.02.5 NOTICE TO PROCEED

A written Notice to Proceed will be issued to the Contractor by the Owner or Engineer after the Contract has been executed by the Contractor and the Owner, and the Performance and Public Works Payment Bonds and required insurance and other certificates and documents are approved by the Owner and, when applicable, by State or Federal agencies responsible for funding any portion of the project. The Contractor shall not commence Work until the Notice to Proceed has been issued.

SECTION 3 - GENERAL REQUIREMENTS OF THE CONTRACT

3.01 SCOPE OF THE WORK

3.01.1 INTENT OF THE CONTRACT

The intent of the Contract is to describe a functionally complete project to be constructed in accordance with the Contract. The Contractor shall provide all labor, supervision, materials, tools, equipment, transportation, supplies, and other things required expressly by, or reasonably implied from, the Contract, to complete all Work. Omissions from the Contract of details of Work which are necessary to carry out the intent of the Contract, or which are customarily performed, shall not relieve the Contractor from performing the complete Work called for by the Contract; such Work shall be performed as if fully set forth and described in the Contract. The unit or other bid prices shall be full payment for everything required to complete the Work, including but not limited to labor, supervision, materials, equipment, jobsite and home office overhead and profit.

3.01.2 COORDINATION OF CONTRACT

The Contract Plans and the Contract Provisions for the Work shall be considered as a whole, and anything shown or called for in one and omitted in any other is as binding as if called for or shown on both. Figure dimensions shall, in all cases, be used in preference to scale dimensions. Any inconsistency in the Contract Documents shall be resolved by the following order of precedence (e.g., 1 presiding over 2 through 4, 2 presiding over 3 through 4, etc.):

1. Addenda;
2. The Agreement and Proposal Form;
3. Specifications;
 - 3a. Supplementary General Conditions (including conditions supplied by federal or state agencies on projects funded, in whole or part, by such agencies. In the event of a conflict in various forms of General Conditions, those conditions affording the greatest benefit or protection to the Owner shall govern.);
 - 3b. General Conditions;
 - 3c. Technical Specifications;
4. Contract Plans.

3.01.3 ASSIGNMENT OF CONTRACT

The Contractor shall not assign the Contract or any part of the Contract or of the funds to be received under the Contract unless such assignment is approved by the Owner and the Contractor's Performance and Public Works Payment Bonds surety prior to the execution or effectiveness of the assignment.

3.02 CONTROL OF WORK

3.02.1 AUTHORITY AND ROLE OF THE ENGINEER

- (1) The Engineer is the authorized representative of the Owner, and is employed to act as advisor and consultant to the Owner in engineering matters relating to the Contract. Among other things, the Engineer may determine the quantity of material installed or work completed, evaluate whether materials and equipment comply with the Specifications, and assist the Owner with answering questions relating to the meaning and intent of the Contract. The Owner, with the advice of the Engineer, will make the final determination relating to quality, acceptability and conformity of labor and materials to the requirements of the Contract.
- (2) The Engineer does not purport to be a safety expert, and is not engaged in that capacity under the Contract or the Engineer's contract with the Owner. The Engineer does not have either the authority or the responsibility to enforce construction safety laws, rules, regulations or procedures, or to order the stoppage of Work for claimed violations thereof. From time to time, the Engineer may inform the Contractor of conditions that may constitute safety issues or violations. Such information will be provided solely to cooperate with and assist the Contractor and shall not make the Field Representative or the Engineer responsible for the enforcement of safety laws, rules, regulations or procedures. After receiving information relating to safety issues from the Engineer, the Contractor shall make its own examination and analysis of the situation reported and take such action, if any, that the Contractor determines to be appropriate. The Engineer's performance of project representation and observation services shall not make the Engineer responsible for the enforcement of safety laws, rules, regulations or procedures; nor shall it make the Engineer responsible for construction means, methods, techniques, sequences, or procedures, or for the Contractor's failure to properly perform the Work, all of which are entirely the responsibility of the Contractor.
- (3) The Engineer shall have no liability whatsoever to, or contractual relationship with, the Contractor in any way relating to the Contract. The Owner and the Contractor shall look solely to each other for the enforcement with respect to any rights, obligations, claims or liabilities arising under or in any way relating to the Contract. Neither the authority given to the Engineer herein, nor any action or service provided by the Engineer or its subconsultants with regard to the Project, shall create any duty owed by the Engineer or its subconsultants to the Contractor or a cause of action against the Engineer or its subconsultants by Contractor.
- (4) Nothing in the Contract shall, in any way, be construed to place responsibility on the Field Representative, Engineer or the Owner for the method, manner, direction or superintendency of the performance of the Work by the Contractor. Such responsibility rests solely with the Contractor.

- (5) Neither the Engineer nor any of its assistants or agents shall have any power to waive any obligation of the Contract. The Engineer's failure to reject Work that is defective or otherwise does not comply with the requirements of the Contract shall not constitute approval or acceptance of the Work or relieve the Contractor of its obligations under the Contract, notwithstanding that such Work has been estimated for payment or that payments have been made for that Work. Neither shall such failure to reject Work, nor any acceptance by the Engineer or by the Owner of any part or of the whole of the Work bar a claim by the Owner at any subsequent time for recovery of damages for the cost of removal and replacement of any portions of the Work that do not comply with the Contract.
- (6) No order, measurement, determination or certificate by the Engineer or Owner for payment of money or payment for or acceptance of the whole or of any part of the Work by the Engineer or the Owner or extension of time or possession taken by the Owner shall constitute a waiver of any portion of the Contract, nor shall any waiver of any breach of the Contract constitute a waiver of any other or subsequent breach thereof.

3.02.2 AUTHORITY OF FIELD REPRESENTATIVE

- (1) Field Representatives are assigned to the project site to keep the Engineer and Owner generally informed as to the progress of the Work and the manner in which it is being done; to keep records; and to act as liaison between the Contractor, Owner and Engineer. When observed, the Field Representative shall call the attention of the Contractor to any deviations from the Contract. However, failure of the Field Representative to call the attention of the Contractor to faulty Work or deviations from the Contract shall not constitute either a waiver of any requirement in the Contract or acceptance of said Work.
- (2) Since one of the Field Representative's primary responsibilities is to observe that the Work progresses expediently and in a workmanlike manner, he or she may offer suggestions to the Contractor, which the Contractor, at its sole discretion, may or may not choose to follow. Such suggestions are not to be considered as anything but suggestions offered to cooperate with and assist the Contractor and shall not constitute an assumption of responsibility, financial or otherwise, by the Field Representative, the Engineer or the Owner.
- (3) The presence or absence of the Field Representative on the job site will be at the sole discretion of the Owner, and the presence or absence of the Field Representative at any time will not relieve the Contractor of its responsibility to properly perform the Work as required by the Contract.
- (4) The Field Representative will have the authority, but not the obligation, to reject defective materials and equipment if observed; however, the failure of the Field Representative to reject defective materials and equipment or any other Work involving deviations from the Contract will not constitute acceptance of such Work. The Field Representative is not authorized to approve or accept any portion of the

Work or to issue instructions contrary to the Contract; all such approvals, acceptances or instructions shall be in writing and signed by the Engineer or the Owner.

- (5) The Field Representative does not purport to be a safety expert, and is not engaged in that capacity under the Contract or the Engineer's contract with the Owner. The Field Representative does not have either the authority or the responsibility to enforce construction safety laws, rules, regulations or procedures, or to order the stoppage of Work for claimed violations thereof. From time to time, the Field Representative may inform the Contractor of conditions that may constitute safety issues or violations. Such information will be provided solely to cooperate with and assist the Contractor and shall not make the Field Representative or the Engineer responsible for the enforcement of safety laws, rules, regulations or procedures. After receiving information relating to safety issues from the Field Representative, the Contractor shall make its own examination and analysis of the situation reported and take such action, if any, that the Contractor determines to be appropriate. The Field Representative's performance of observation services shall not make the Field Representative responsible for the enforcement of safety laws, rules, regulations or procedures; nor shall it make the Field Representative responsible for construction means, methods, techniques, sequences, or procedures, or for the Contractor's failure to properly perform the Work, all of which are entirely the responsibility of the Contractor.

3.02.3 CONSTRUCTION OBSERVATION AND INSPECTIONS

- (1) All Work required by the Contract, including all materials and equipment to be furnished and the manufacture and preparation thereof shall, at all times, be subject to observation by the Owner's designated representatives, who may, at any time in the performance of their duties, enter upon the Work or the shops and factories where any part of the Work, materials or equipment are being prepared, fabricated or manufactured.
- (2) Observation of Work by the Owner, the Engineer, or the Field Representative shall not relieve the Contractor of its obligation to furnish satisfactory materials and workmanship. Work or materials found unsatisfactory at any time during the life of the Contract, and the applicable warranty periods, guarantees or limitation periods shall be promptly corrected or replaced immediately by the Contractor at its own expense.
- (3) Upon request by the Owner or Engineer, the Contractor shall furnish all tools, labor, equipment and materials necessary to examine any Work that may be completed or in progress, even to the extent of uncovering or taking down portions of completed or covered Work. Work shall be left exposed until examined by the Owner or Engineer, at no additional cost to the Owner. If the Owner or the Engineer determines that the uncovered Work does not comply with the requirements of the Contract, the cost of such examination and the cost of reconstruction and/or repair shall be borne by the Contractor.

- (4) The Contractor shall promptly comply with all directions of the Engineer with reference to correcting any Work or replacing any materials or equipment found to be not in accordance with the Contract. In the event of a dispute, the Contractor may appeal to the Engineer's decision to the Owner in accordance with the Contract, and the Owner's decision shall be final.

3.02.4 EMERGENCY CONTACT LIST

The Contractor shall submit an emergency contact list to the Engineer no later than five calendar days after the date the contract is executed. The list shall include the Contractor's project manager or equivalent, project superintendent, traffic control supervisor, and erosion and sediment control lead, as applicable. The list shall identify a representative with delegated authority to act as the emergency contact on behalf of the Contractor and include one or more alternates. The emergency contact shall be available upon the Engineer's request at other than normal working hours. The emergency contact list shall include 24-hour telephone numbers for all individuals identified as emergency contacts or alternates.

3.02.5 ORAL AGREEMENTS

No oral agreement or conversation with any officer, agent, or employee of the Owner, either before or after execution of the contract, shall affect or modify any of the terms or obligations contained in any of the documents comprising the contract. Such oral agreement or conversation shall be considered as unofficial information and in no way binding upon the Owner, unless subsequently put in writing and signed by the Owner.

3.02.6 ELECTRONIC FILES

All Work performed shall be in conformity with the signed Contract Plans and Contract Provisions. If the Contractor requests electronic files, the Engineer may provide the files. The use of the electronic files shall be at the Contractor's sole risk. The Engineer does not warrant the completeness or accuracy of the electronic files and the Engineer assumes no liability for any errors or omissions in the digital data. The Contractor shall be responsible for reviewing and checking the electronic files to ensure that they are suitable for the Contractor's purpose.

3.03 LEGAL RELATIONS AND RESPONSIBILITIES

3.03.1 APPLICABLE LAWS AND REGULATIONS

3.03.1(1) General

The Contractor shall comply with all laws, ordinances, rules and regulations of any authority having jurisdiction in any way relating to the project, including, but not limited to, regulations governing site maintenance, clean-up, air pollution control, noise control, water quality control, surface water control and runoff, tree and vegetation protection, cultural resources and oil and hazardous substance control.

3.03.1(2) Utilities and Similar Facilities

The Contractor shall protect all private and public utilities from damage. Utilities include, among others: telephone lines; cable television and high-speed internet lines; gas; electric power lines; sanitary sewer; sewer; storm sewer and water lines; street lighting and traffic signal and signing systems; and railroad tracks and related equipment.

In accordance with Chapter 19.122 of the Revised Code of Washington, the Contractor shall call the One-Number Locator Service for the field location of underground utilities. If no locator service is available for the area where the project is located, the Contractor shall provide written notice to all owners of utilities known to, or suspected of, having underground facilities within or near all areas of that will be excavated.

If the Work requires removing or relocating one or more utilities, the Contract will assign the task to the Contractor or utility owner. When this task is assigned to the utility owner and that work is not complete before the Contractor begins work, the Contractor shall immediately notify the Engineer in writing.

To expedite the removal or relocation work or to make that work more efficient, the Contractor may ask utility owners to move, remove, or alter their utilities or equipment in ways other than those specified in the Contract. If so, the Contractor shall make the arrangements with the utility owner and pay all costs associated therewith.

The Contractor shall be responsible for all costs required to protect public and private utilities from damage, including the costs of removal and replacement.

3.03.1(3) Site Maintenance

The Contractor shall keep the Work site, staging areas, and Contractor's facilities clean and free from rubbish and debris. Materials and equipment shall be removed from the Work site when they are no longer necessary. Upon completion of the Work and before final acceptance, the Work site shall be cleared of equipment, unused materials, and rubbish and the Work site shall be left in clean and neat condition.

3.03.1(4) State Taxes

The Washington State Department of Revenue has issued special rules on the State sales tax. Section 3-03.1(4) a through Section 3-03.1(4) c are meant to clarify those rules. The Contractor should contact the Washington State Department of Revenue for answers to questions in this area. The Owner will not adjust its payment if the Contractor bases a bid on a misunderstood tax liability.

The Contractor shall include all Contractor-paid taxes in the unit bid prices or other contract amounts. In some cases, however, state retail sales tax will not be included. Section 3-03.1(4) b describes this exception.

The Owner will pay the retained percentage only if the Contractor has obtained from the Washington State Department of Revenue a certificate showing that all contract-related taxes have been paid (RCW 60.28.051). The Owner may deduct from its payments to the Contractor any amount the Contractor may owe the Washington State Department of Revenue, whether the amount owed relates to the Contract or not. Any amount so deducted will be paid into the proper State fund.

a. State Sales Tax — Rule 171

WAC 458-20-171, and its related rules, apply to building, repairing, or improving streets, roads, etc., which are owned by a municipal corporation, or political subdivision of the state, or by the United States, and which are used primarily for foot or vehicular traffic. This includes storm or combined sewer systems within and included as a part of the street or road drainage system and power lines when such are part of the roadway lighting system. For work performed in such cases, the Contractor shall include Washington State Retail Sales Taxes in the various unit bid item prices, or other contract amounts, including those that the Contractor pays on the purchase of the materials, equipment, or supplies used or consumed in doing the work.

b. State Sales Tax — Rule 170

WAC 458-20-170, and its related rules, apply to the constructing and repairing of new or existing buildings, or other structures, upon real property. This includes, but is not limited to, the construction of streets, roads, highways, etc., owned by the state of Washington; water mains and their appurtenances; sanitary sewers and sewage disposal systems unless such sewers and disposal systems are within, and a part of, a street or road drainage system; telephone, telegraph, electrical power distribution lines, or other conduits or lines in or above streets or roads, unless such power lines become a part of a street or road lighting system; and installing or attaching of any article of tangible personal property in or to real property, whether or not such personal property becomes a part of the realty by virtue of installation.

For work performed in such cases, the Contractor shall collect from the Owner, retail sales tax on the full contract price. The Owner will automatically add this sales tax to each payment to the Contractor. For this reason, the Contractor shall not include the retail sales tax in the unit bid item prices, or in any other contract amount subject to Rule 170, with the following exception.

EXCEPTION: The Owner will not add in sales tax for a payment the Contractor or a subcontractor makes on the purchase or rental of tools, machinery, equipment, or consumable supplies not integrated into the project. Such sales taxes shall be included in the unit bid item prices or in any other contract amount.

c. Services

The Contractor shall not collect retail sales tax from the Owner on any contract wholly for professional or other services (as defined in Washington State Department of Revenue Rules 138 and 244).

3.03.1(5) Equal Employment Responsibilities

The Contractor shall, at its sole cost and expense, comply with all applicable laws, policies and regulations pertaining to nondiscrimination and equal employment opportunities. The absence of specific provisions or other requirements mandated by state, municipal or federal laws, policies or regulations from these General Conditions shall not excuse the Contractor from compliance with such laws, regulations or policies.

3.03.1(6) Archaeological and Historical Objects

Archaeological or historical objects, such as ruins, human skeletal remains, sites, buildings, artifacts, fossils, or other objects of antiquity that may have significance from a historical or scientific standpoint, which may be encountered by the Contractor, shall not be further disturbed. The Contractor shall immediately notify the Engineer of any such finds.

The Engineer will determine if the material is to be salvaged. The Contractor may be required to stop work in the vicinity of the discovery until such determination is made. The Engineer may require the Contractor to suspend Work in the vicinity of the discovery until salvage is accomplished.

If the Engineer finds that the suspension of Work in the vicinity of the discovery increases or decreases the cost or time required for performance of any part of the Work under the Contract, the Engineer will make an adjustment in payment or the time required for the performance of the work in accordance with Section 3.04.6.

3.03.2 SAFETY MEASURES

All Work under the Contract shall be performed in a safe manner. The Contractor and all subcontractors shall comply with all applicable rules, regulations, and safety standards of the Washington State Department of Labor and Industries and all other federal, state, local and other governmental entities having jurisdiction over the project. The Contractor shall be solely and completely responsible for the conditions of the job site, including the safety of all persons and property during the performance of the Work. This requirement shall apply continuously and not be limited to normal working hours.

The Engineer's review of the Contractor's work plan, safety plan, construction sequences, schedule or performance does not and is not intended to include review or approval of the adequacy of the Contractor's safety measures in, on, or near the job site. The Engineer does not purport to be a safety expert, and is not engaged in that capacity under the Contract. The Engineer has neither the authority nor the responsibility to enforce construction safety laws, rules, regulations, or procedures, or to order the stoppage of Work for claimed violations thereof.

The Contractor shall exercise all required and appropriate precautions to protect all persons and property from injury and damage.

3.03.3 HAZARDOUS MATERIAL

Biological hazards and associated physical hazards may be present at the Work site. The Contractor shall take precautions and perform any necessary Work to provide and maintain a safe and healthful Work site in accordance with all applicable laws. The cost for all Work necessary to provide and maintain a safe Work site shall be included in the Contractor's Proposal, unless the Contract includes provisions to the contrary.

3.03.4 PAYMENT OF WAGES AND RELATED REQUIREMENTS

3.03.4(1) Minimum Prevailing Wage Requirements

- a. The Contract is subject to the minimum prevailing wage and hour requirements of RCW 39.12 and RCW 49.28 (as amended or supplemented). The Contract may list minimum hourly rates for wages for trades or occupations in the locality within the state where such labor is performed as determined by the Industrial Statistician for the Department of Labor and Industries. These rates are for general reference purposes only and may not be current or complete. The Contractor, any subcontractor, or other person doing any Work under the Contract shall not pay any worker less than the applicable current minimum hourly wage rates required by applicable law. Higher wages and benefits may be paid.
- b. The Contractor, any Subcontractor, and all individuals or firms required by RCW 39.12, WAC 296-127 to pay minimum prevailing wages, shall not pay any worker less than the minimum hourly wage rates and fringe benefits required by RCW 39.12. Higher wages and benefits may be paid.
- c. In accordance with WAC 296-127, the applicable prevailing wage rates that are in effect on the date when Proposals are due shall remain in effect for the duration of the Contract. By incorporating prevailing wage rates into the Contract, the Owner does not warrant or imply that the Contractor will find labor available at those rates. The Contractor shall calculate in its Proposal any amounts above the minimums that it will actually have to pay. Further, rates for wages and/or fringe benefits may change while the Contract is in force. If they do, the Contractor shall bear the cost of paying rates above those in effect at time of bid.
- d. If employing labor in a class not listed in the Contract Provisions on State funded projects, the Contractor shall request the Industrial Statistician, Department of Labor and Industries to determine the correct wage and benefits rate.
- e. If employing labor in a class not listed in the Contract Provisions on a federally funded project, the Contractor shall request the U.S. Secretary of Labor to determine the correct wage and benefits rate.

- f. The Contractor shall ensure that any firm (Supplier, Manufacturer, or Fabricator) that falls under the provisions of RCW 39.12 because of the definition “Contractor” in WAC 296-127-010, complies with all the requirements of RCW 39.12.
- g. The Contractor shall be responsible for compliance with the requirements of the RCW 39.12 by all firms (Subcontractors, lower tier subcontractors, Suppliers, Manufacturers, or Fabricators) engaged in any part of the Work necessary to complete the Contract. Therefore, should a violation of this Subsection occur by any firm that is providing Work or materials for completion of the Contract whether directly or indirectly responsible to the Contractor, the Owner will take action against the Contractor, as provided by the provisions of the Contract, to achieve compliance, including, but not limited to, withholding payment on the Contract until compliance is achieved.
- h. The State of Washington prevailing wage rates for this public works project can be found on the following Labor and Industries link: <https://lni.wa.gov/licensing-permits/public-works-projects/prevailing-wage-rates>. The applicable rates should be rates effective on the bid opening date for Journey Level and Apprentice Level in Mason County. A copy of the State of Washington prevailing wage rate determination will also be available for review at the Mason County PUD No. 1 office.

3.03.4(2) Posting Notice Requirements

Notice of intent to pay prevailing wages and prevailing wage rates for the project shall be posted for the benefit of workers. The Contractor shall post the following, together with anything else necessary to comply with all applicable laws and regulations:

- a. One copy of the approved “Statement of Intent to Pay Prevailing Wages” for the Contractor, each subcontractor, and any other firm (Supplier, Manufacturer, of Fabricator) that falls under the provisions of RCW 39.12 because of the definition of “Contractor” in WAC 296-127-010;
- b. One copy of the prevailing wage rates for the project;
- c. The address and telephone number of the Industrial Statistician for the Department of Labor and Industries, along with a statement that complaints and questions about wage rates may be directed there; and

Notice shall be posted at a location readily visible to workers at the job site, or where no field office is established, at a local office. The Contractor shall supply a copy of the Notice to any employee upon request.

3.03.4(3) Apprentices

If employing apprentices, the Contractor shall submit to the Owner written evidence showing:

- a. That each apprentice is enrolled in a program approved by the Washington State Apprenticeship and Training Council;
- b. The progression schedule for each apprentice; and
- c. The established apprentice-journeyman ratios and wage rates in the project locality upon which the Contractor shall base such ratios and rates under the contract. Any worker for whom an apprenticeship agreement has not been registered and approved by the Washington State Apprenticeship and Training Council shall be paid the prevailing hourly rate for journeymen provided in RCW 39.12.021.

3.03.4(4) Required Documents

1. General

All “Statements of Intent to Pay Prevailing Wages”, “Affidavits of Wages Paid” and Certified Payrolls shall be submitted on the State L&I online Prevailing Wage Intent & Affidavit (PWIA) system. Statements of Intent to Pay Prevailing Wages”, and “Affidavits of Wages Paid” shall also be submitted to the Engineer. When requested by the Engineer, Certified Payrolls shall also be submitted to the Engineer.

2. Intents and Affidavits

On forms provided by the Industrial Statistician of State L&I, the Contractor shall submit to the Engineer the following for themselves and for each firm covered under RCW 39.12 that will or has provided Work and materials for the Contract:

- a. The approved “Statement of Intent to Pay Prevailing Wages” State L&I’s form number F700-029-000. The Contracting Agency will make no payment under this Contract until this statement has been approved by State L&I and reviewed by the Engineer.
- b. The approved “Affidavit of Prevailing Wages Paid”, State L&I’s form number F700-007-000. The Contracting Agency will not grant Completion until all approved Affidavit of Wages paid for the Contractor and all Subcontractors have been received by the Engineer. The Contracting Agency will not release to the Contractor any funds retained under RCW 60.28.011 until “Affidavit of Prevailing Wages Paid” forms have been approved by State L&I and all of the approved forms have been submitted to the Engineer for every firm that worked on the Contract.

The Contractor is responsible for requesting these forms from State L&I and for paying any fees required by State L&I.

3. Certified Payrolls

Certified payrolls are required to be submitted by the Contractor for themselves, all Subcontractors and all lower tier subcontractors. The payrolls shall be submitted no less than monthly on State funded projects.

4. Penalties for Noncompliance

The Contractor is advised, if these payrolls are not supplied within the prescribed deadlines, any or all payments may be withheld until compliance is achieved. In addition, failure to provide these payrolls may result in other sanctions as provided by State laws (RCW 39.12.050).

3.03.5 BONDS, INSURANCE AND INDEMNITY OBLIGATIONS

3.03.5(1) Contract Bonds

The successful bidder shall provide an executed Performance Bond and Public Works Payment Bond for the full Contract amount (including sales tax). The Contract Bonds shall:

1. Be on Owner-furnished forms;
2. Be signed by an approved Surety (or Sureties) that:
 - a. Is registered with the Washington State Insurance Commissioner; and
 - b. Appears on the current Authorized Insurance List in the State of Washington published by the Office of the Insurance Commissioner.
3. Be conditioned upon the faithful performance of the Contract by the Contractor within the prescribed time; and
4. Guarantee that the Surety shall indemnify, defend, and protect the Owner against any claim of direct or indirect loss resulting from the failure:
 - a. Of the Contractor (or any of the employees, Subcontractors, or lower tier subcontractors of the Contractor) to faithfully perform the Contract; or
 - b. Of the Contractor (or the Subcontractors or lower tier subcontractors of the Contractor) to pay all laborers, mechanics, Subcontractors, lower tier subcontractors, materialperson, or any other person who provides supplies or provisions for carrying out the Work.
5. Be accompanied by a power of attorney for the Surety's officer empowered to sign the bond; and

6. Be signed by an officer of the Contractor empowered to sign official statements (sole proprietor or partner). If the Contractor is a corporation, the bond must be signed by the president or vice-president, unless accompanied by written proof of the authority of the individual signing the bond to bind the corporation (i.e., corporate resolution, power of attorney or a letter to such effect by the president or vice-president).

The Owner may require Sureties or Surety companies on the Contract Bonds to appear and qualify themselves. Whenever the Owner deems the Surety or Sureties to be inadequate, it may, upon written demand, require the Contractor to furnish additional Surety to cover any remaining Work. Until the added Surety is furnished, payments on the Contract will stop.

3.03.5(1.1) Two-Year Guarantee Period

The Contractor shall return to the project and repair or replace all defects in workmanship and material discovered within 2 years after Final Acceptance of the Work. The Contractor shall start work to remedy any such defects within 7 calendar days of receiving Owner's written notice of a defect, and shall complete such work within the time stated in the Owner's notice. In case of an emergency, where damage may result from delay or where loss of services may result, such corrections may be made by the Owner's own forces or another contractor, in which case the cost of corrections shall be paid by the Contractor. In the event the Contractor does not accomplish corrections within the time specified, the work will be otherwise accomplished and the cost of same shall be paid by the Contractor.

When corrections of defects are made, the Contractor shall then be responsible for correcting all defects in workmanship and materials in the corrected work for 2 years after acceptance of the corrections by Owner.

This guarantee is supplemental to and does not limit or affect the requirements that the Contractor's work comply with the requirements of the Contract or any other legal rights or remedies of the Owner.

3.03.5(2) Worker's Benefits

- a. The Contractor shall make all payments required for unemployment compensation under RCW Title 50 and for industrial insurance and medical aid required under RCW Title 51. If any payment required by Title 50 or Title 51 is not made when due, the Contractor shall indemnify the Owner with respect to all costs and damages, including attorneys' fees and expenses, associated with such nonpayment. The Owner may retain payments due under Title 50 or Title 51 from any money due to the Contractor and make payment to the appropriate fund.
- b. The Contractor shall include in the various items in its bid Proposal all costs for payment of unemployment compensation and for providing the required insurance coverage(s). The Contractor will not be entitled to any additional payment for: (1) failure to include such costs in the Proposal, or (2) post-Award determinations made by the U.S. Department of Labor, the Washington State Department of Labor and

Industries, or any other agency or entity regarding insurance coverage requirements.

3.03.5(4) Public Liability & Property Damage Insurance

3.03.5(4.1) General Requirements

- A. The Contractor shall procure and maintain insurance described in all subsections in this Section, from insurers with a current A.M. Best rating not less than A – VII and licensed to do business in the state of Washington. The Owner reserves the right to approve or reject the insurance provided, based on the insurer (including financial condition), terms and coverage, the Certificate of Insurance, and/or endorsements.
- B. The Contractor shall keep this insurance in force during the term of the Contract and for 30 days after the Physical Completion Date, unless otherwise indicated.
- C. All insurance coverage required by this section shall be written and provided by “occurrence-based” policy forms rather than by “claims made” forms.
- D. The insurance policies shall contain a “cross liability” provision.
- E. The Contractor’s and all subcontractors’ insurance coverage shall be primary and non-contributory insurance as respects the Owner’s insurance, self-insurance, or insurance pool coverage. Any insurance, self-insurance or self-insured pool coverage maintained by the Owner shall be excess of the Contractor’s insurance and shall not contribute with it.
- F. The Contractor shall provide the Owner and all Additional Insured with written notice of any policy cancellation and the date of effective cancellation within 2 business days of receipt.
- G. The Contractor shall not begin work under the Contract until the required insurance has been obtained and approved by the Owner.
- H. Failure on the part of the Contractor to maintain the insurance as required shall constitute a material breach of Contract, upon which the Owner may, after giving 5 business days notice to the Contractor to correct the breach, immediately terminate the Contract or, at its discretion, procure or renew such insurance and pay any and all premiums in connection therewith, with any sums so expended to be repaid to the Owner on demand, or at the sole discretion of the Owner, offset against funds due the Contractor from the Owner.
- I. All costs for insurance shall be incidental to and included in the unit or lump sum prices of the Contract and no additional payment will be made.

3.03.5(4.2) Additional Insured

All insurance policies, with the exception of Workers Compensation, shall name the following listed entities as additional insured(s) using the forms or endorsements required herein:

- The Owner and its officers, elected officials, employees, agents, and volunteers;
- Gray & Osborne, Inc.;

The above-listed entities shall be additional insured(s) for the full available limits of liability maintained by the Contractor, irrespective of whether such limits maintained by the Contractor are greater than those required by the Contract, and irrespective of whether the Certificate of Insurance provided by the Contractor pursuant to 3.03.5(4.4) describes limits lower than those maintained by the Contractor.

3.03.5(4.3) Subcontractors

Contractor shall ensure that each subcontractor of every tier obtains and maintains at a minimum the insurance coverages listed in 3.03.5(4.5)A and 3.03.5(4.5)B. Upon request of the Owner, the Contractor shall provide evidence of such insurance.

3.03.5(4.4) Verification of Coverage

The Contractor shall deliver to the Owner a Certificate(s) of Insurance and endorsements for each policy of insurance meeting the requirements set forth herein when the Contractor delivers the signed Contract for the Work. The certificate and endorsements shall conform to the following requirements:

1. An ACORD certificate or a form determined by the Owner to be equivalent. The certificate or an endorsement form shall indicate the Contractor's insurance is primary and non-contributory.
2. The Contractor shall obtain endorsement forms CG 2010 10 01, CG 2032 07 04 and CG 2037 10 01 or the equivalent of each, naming the Owner and all other entities listed in 3-03.5(4.2) as Additional Insured(s) and showing the policy number. If the Contractor is unsuccessful in securing these endorsements after exerting commercially reasonable efforts, the Contractor shall obtain other endorsements providing equivalent protection to the Additional Insured. Commercially reasonable efforts shall be evidenced by a signed statement by the Contractor's insurance broker indicating that endorsement forms CG 2010 10 01, CG 2032 07 04 and CG 2037 10 01 are not available and the endorsements submitted provide equivalent protection to the Additional Insured.
3. Any other amendatory endorsements to show the coverage required herein.
4. A notification of coverage enhancements on the Certification of Insurance shall not satisfy these requirements; actual endorsement must be submitted.

Upon request, the Contractor shall forward to the Owner a full and certified copy of the insurance policy(s). If Builders Risk Insurance is required on this Project, a full and certified copy of that policy is required when the Contractor delivers the signed Contract for the Work.

3.03.5(4.5) Coverages and Limits

The insurance shall provide the minimum coverages and limits set forth below. Providing coverage in these stated minimum limits shall not be construed to relieve the Contractor from liability in excess of such limits. All deductibles and self-insured retentions shall be disclosed and are subject to approval by the Owner. The cost of any claim payments falling within the deductible shall be the responsibility of the Contractor.

3.03.5(4.5)A Commercial General Liability

Commercial General Liability insurance shall be written on coverage forms at least as broad as ISO occurrence form CG 00 01, including but not limited to liability arising from premises, operations, stop gap liability, independent contractors, products-completed operations, personal and advertising injury, and liability assumed under an insured contract. There shall be no exclusion for liability arising from explosion, collapse or underground property damage.

The Commercial General Liability insurance shall be endorsed to provide a per project general aggregate limit, using ISO form CG 25 03 05 09 or an equivalent endorsement.

Contractor shall maintain Commercial General Liability Insurance arising out of the Contractor's completed operations for at least 3 years following Substantial Completion of the Work.

Such policy must provide the following minimum limits:

\$1,000,000	Each Occurrence
\$2,000,000	General Aggregate
\$2,000,000	Products & Completed Operations Aggregate
\$1,000,000	Personal & Advertising Injury, each offence
\$1,000,000	Stop Gap/Employers' Liability

3.03.5(4.5)B Automobile Liability

Automobile Liability for owned, non-owned, hired, and leased vehicles, with an MCS 90 endorsement and a CA 9948 endorsement attached if "pollutants" are to be transported. Such policy(ies) shall provide the following minimum limit:

\$1,000,000 combined single limit each accident

3.03.5(4.5)C Workers' Compensation

The Contractor shall comply with Workers' Compensation coverage as required by the Industrial Insurance laws of the state of Washington.

3.03.5(4.5)D Excess or Umbrella Liability

The Contractor shall provide Excess or Umbrella Liability coverage at limits of \$2 million per occurrence and annual aggregate. This excess or umbrella liability coverage shall apply, at a minimum, to both the Commercial General and Auto insurance policy coverage and employers liability.

This requirement may be satisfied instead through the Contractor's primary Commercial General and Automobile Liability coverage, or any combination thereof.

3.03.5(4.5)I Marine Pollution

If this Contract is near or on water, the Contractor shall procure and maintain Pollution Liability (OPA, CERCLA) insurance to satisfy U.S. Coast Guard requirements as respects the Federal Oil Pollution Act of 1990 and the Comprehensive Environmental Response, Compensation and Liability Act of 1980 as amended.

Such policy must provide the following minimum limits, or statutory limits of liability as applicable, whichever is higher:

\$1,000,000 per Occurrence

3.03.5(4.5)J Pollution Liability

If this Contract includes work with lead based paint, materials containing asbestos or transportation of hazardous materials, the Contractor shall provide a Contractors Pollution Liability policy, providing coverage for claims involving bodily injury, property damage (including loss of use of tangible property that has not been physically injured), cleanup costs, remediation, disposal or other handling of pollutants, including costs and expenses incurred in the investigation, defense, or settlement of claims, arising out of any one or more of the following:

1. Contractor's operations related to this project.
2. Remediation, abatement, repair, maintenance or other work with lead-based paint or materials containing asbestos.
3. Transportation of hazardous materials away from any site related to this project.

All entities listed under 3.03.5(4.2) of these Special Provisions shall be named by endorsement as additional insureds on the Contractors Pollution Liability insurance policy.

Such Pollution Liability policy shall provide the following minimum limits:

\$1,000,000 each loss and annual aggregate

3.03.5(4.5)K Professional Liability

If the Contract requires engineering design services, the Contractor and/or its Subcontractor(s) and/or its design consultant providing construction management, value engineering, or any other design-related non-construction professional services shall provide evidence of Professional Liability insurance covering professional errors and omissions.

Such policy shall provide the following minimum limits:

\$1,000,000 per claim and annual aggregate

If the scope of such design-related professional services includes work related to pollution conditions, the Professional Liability insurance shall include coverage for Environmental Professional Liability.

If insurance is on a claims made form, its retroactive date, and that of all subsequent renewals, shall be no later than the effective date of this Contract.

3.03.5(5) Indemnity and Hold Harmless

- a. To the fullest extent permitted by law and subject to the limitations of RCW 4.24.115, the Contractor shall defend, indemnify and hold harmless the Owner and the Engineer and their appointed and elective officers, agents and employees from and against all claims, damages, losses and expenses, including but not limited to attorneys' fees and expenses arising out of or resulting from the negligent performance of the Work, provided that any such claim, damage, loss or expense (1) is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) including the loss of use resulting therefrom, and (2) is caused by any negligent act or omission of the Contractor, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable. Provided, however, that when any such claim, damage, loss or expense arises from the concurrent negligence of (1) the Owner, or anyone for whose acts it may be liable, and (2) the Contractor, or anyone for whose acts it may be liable, it is expressly agreed that the Contractor's obligations of defense and indemnity under this section shall be effective only to the extent of the Contractor's negligence and those for whose negligence the Contractor is responsible. This obligation of indemnity shall not extend to claims, losses or expenses arising from the sole negligence of the Owner, its appointed or elected officials, agents or employees.
- b. In any and all claims against the Owner or the Engineer or any of their agents or employees by any employee of the Contractor, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the indemnification obligation under this section shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor or any Subcontractor under workmen's

compensation acts, disability benefit acts or other employee benefit acts, it being the expressed intent of the parties that Contractor herein specifically waives any immunity granted under the State Industrial Insurance Law, RCW Title 51. **THIS WAIVER HAS BEEN SPECIALLY NEGOTIATED BY THE PARTIES, WHO HAVE ACKNOWLEDGED SAME BY AFFIXING THEIR SIGNATURES TO THE PROPOSAL FORM.**

3.03.5(6) Patent Royalties & Process Fees

The Contractor shall be responsible for all costs arising from the use of patented devices, materials, or processes used in or incorporated in the Work. The Contractor agrees to indemnify, defend, and save harmless the Owner from all claims and damages, in any way relating to the use of patented devices, materials, or processes used in or incorporated in the Work.

3.03.6 METHOD OF SERVING NOTICE

All correspondence from the Contractor constituting any notification, notice of protest, notice of dispute, or other correspondence constituting notification required to be furnished under the Contract, shall be in paper format, hand delivered or sent via mail delivery service to the Owner. Electronic formats such as emails or electronically delivered copies of correspondence will not constitute such notice and will not comply with the requirements of the Contract.

3.04 PROSECUTION AND PROGRESS OF THE WORK

3.04.1 QUALITY OF WORK

3.04.1(1) Workmanship

- a. The Contractor represents that it is fully experienced and possesses all the necessary capital, facilities and expertise to perform all of the Work, and hereby guarantees that all of the Work performed by it under the Contract will be of the highest quality and done in a workmanlike fashion in strict accordance with the requirements of the Contract.
- b. The Contractor shall at all times employ skilled workmen and use skilled Subcontractors in the performance of the Work. When required in writing by the Owner or the Engineer, the Contractor or its Subcontractors shall remove from the Work site any person or Subcontractor who is, in the opinion of the Owner or the Engineer, not competent, not qualified, disorderly, or otherwise unsatisfactory and shall not again employ such discharged person or Subcontractor on the Work, except with the prior written consent of the Owner. Discharge of any person or Subcontractor shall not be the basis of any claim for compensation or damages against the Owner or the Engineer.
- c. All Work performed under the Contract shall be of first quality workmanship throughout, with the Work complete and in full working order upon completion.

- d. Except when otherwise expressly specified in the Contract, the Contractor shall design, survey, layout and be responsible for all methods, materials and equipment used in performing the Work.
- e. If, at any time, the Contractor's workforce (including Subcontractors), in the opinion of the Owner and/or the Engineer, shall be inadequate for maintaining the necessary progress required to complete the Work within the Contract Time, the Contractor shall, if so required by the Owner and/or the Engineer, increase the workforce or equipment to such an extent as to give reasonable assurance of compliance with the Work schedule. The failure of the Owner and/or the Engineer to make such demand shall not relieve the Contractor of its obligation to perform the Work in accordance with the requirements of the Contract. The Contractor alone shall be responsible for the safety, efficiency and adequacy of its activities, construction methods and the rate of progress required by the Contract.

3.04.1(2) Contractor's Supervisory and Site Personnel

- a. The Contractor shall assign sufficient supervisory personnel to ensure the faithful prosecution of the Work and shall have adequate supervisory personnel present at the Work site who are either employees of the Contractor or duly authorized representatives designated in writing to the Owner and/or the Engineer. The Contractor shall at all times maintain at the Work site a complete copy of the Contract Provisions, Contract Plans, and record drawings of the Work that has been completed.
- b. The Contractor shall at all times have at least one duly authorized supervisory representative at the Work site who shall be fully authorized to make binding decisions on behalf of the Contractor with respect to the Work. If the Contractor's duly authorized supervisory representative at the Work site will be absent from the Work site for more than four hours, he/she shall designate an assistant who possesses the same authority and so inform the Owner and the Field Representative, if applicable.

3.04.2 MATERIALS AND EQUIPMENT

- (1) Materials and equipment furnished and installed shall be manufactured, fabricated or constructed to meet all applicable safety requirements. All material and equipment supplied by the Contractor and incorporated in the Work shall be of new manufacture, free from defects and in strict compliance with the requirements of the Contract. When required by the Owner, a certificate from the manufacturer or other responsible supplier shall be supplied attesting to this fact.
- (2) All tools and equipment used for construction operations shall be of the size and type suitable for the Work and shall be kept in safe and good working condition at all times.

- (3) The Contractor shall, whenever required during the progress of the Work and after completion of the Work, furnish proof acceptable to the Owner that all items of equipment and all materials installed equal or exceed all requirements specified in the Contract.
- (4) The Contractor shall use all means possible to protect materials and equipment from damage or degradation of any kind before, during and after installation.
- (5) The Contractor shall replace any materials or equipment damaged during the performance of the Work to the approval of the Owner and the Engineer. The cost of replacing damaged materials and equipment shall be borne by the Contractor.

3.04.3 SPECIFICATION OF PARTICULAR MATERIALS AND EQUIPMENT

- (1) Within the Contract, certain items are specified by brand, style, trade name, or manufacturer in order to set forth a standard of quality, and/or preference by the Owner. Unless specifically noted otherwise, it is not the intent of the Contract to exclude other processes or materials of a type and quality equal to those designated.
- (2) The term “or equal” as used in the Contract does not mean that the Contractor’s substitution of material or equipment will necessarily be approved as equal by the Engineer. If the Contractor desires to substitute material or equipment on the basis that it is equal to that specified, the Contractor shall submit a written request to the Engineer to substitute the material or equipment. The Contractor shall not use or incorporate such material or equipment into the Work until the Contractor has received written approval from the Engineer.
- (3) If the Contractor proposes substitutions, the Engineer will record all time used to evaluate each proposed substitution. If an approved substitution requires revisions to the Contract Documents, the Engineer will record all time to accomplish the revisions. Whether or not the Engineer approves a proposed substitution all direct and indirect cost to evaluate the proposed substitution shall be deducted from amounts due or to become due to the Contractor.
- (4) No additional compensation or extension of time will be allowed the Contractor for any changes required to incorporate substituted materials or equipment.

3.04.4 STORAGE

3.04.4(1) On-Site Storage

The Contractor shall store all equipment and materials in a safe and suitable place in accordance with the manufacturer’s recommendations. Materials and equipment shall be covered or wrapped to protect them from moisture, dust and deterioration, as required or necessary. All on-site storage areas shall be approved in advance by the Owner and the Engineer.

3.04.4(2) Off-Site Storage

The Contractor may be required to provide offsite storage of equipment and materials to enable construction to occur at the Work site. The Contractor has full responsibility to secure all offsite storage areas, if needed, and shall include the costs for providing such storage areas in the bid Proposal for the individual equipment and material items requiring off-site storage. All off-site storage areas shall be enclosed or fenced and be secure.

3.04.5 DEFECTIVE MATERIALS, EQUIPMENT AND WORKMANSHIP

- (1) Materials, equipment, or workmanship which, in the opinion of the Owner or the Engineer, does not conform to the Contract or are in any other way unsatisfactory or unsuited to the purpose for which they are intended may be rejected. The Contractor shall remove from the Work site without delay, all rejected materials, equipment and work, and shall promptly replace the same in strict conformity with the requirements of the Contract. Unsatisfactory materials, equipment and workmanship may be rejected at any time, notwithstanding any previous testing, inspection or acceptance of such materials, equipment or workmanship, or inclusion thereof in any previously issued progress estimates.
- (2) If the Contractor fails to correct defective Work, equipment or materials, the Owner shall have the right to exercise any of the following options or any combination thereof:
 - a. The Owner may replace the defective Work, materials or equipment by purchase from or contract with any other parties at the expense of the Contractor, and in this event, the Owner shall be entitled without compensation to the Contractor, to the use of the defective Work or equipment for such reasonable time as is necessary to enable Owner to replace such defective Work, materials or equipment.
 - b. The Owner may elect to accept the defective Work, materials or equipment and issue a Change Order reflecting a credit against the contract price, computed under the terms of the Contract in an amount to be determined by the Engineer, which amount shall reflect the actual value to the Owner of the accepted Work.
 - c. Upon receipt of notice from the Owner of any defects in material, equipment or workmanship which appear within a two-year period following the Substantial Completion Date, or within any other warranty or guarantee period required by the Contract or provided by a manufacturer or supplier, the Contractor shall promptly and with the least possible delay and inconvenience to the Owner, repair or replace such defective workmanship, material or equipment without expense to the Owner.
 - d. The Contractor shall be responsible for the full cost of correcting defective Work and complying with warranties and guarantees as required by the

Contract. Direct or indirect costs, including administrative and engineering, incurred by the Owner attributable to correcting and remedying defective or unauthorized work, or Work the Contractor failed or refused to perform, shall be paid by the Contractor. Payment will be deducted by the Owner from monies due, or to become due, the Contractor. Such direct and indirect costs shall include in particular, but without limitation, compensation for additional professional services required, and costs for repair and replacement of work of others destroyed or damaged by correction, removal, or replacement of the Contractor's unauthorized work.

- e. All warranties, guarantees, and other obligations to correct work that does not comply with the Contract are material requirements of the Contract. The performance of all warranties, guarantees and other obligations shall be secured by the Performance Bond and the Public Works Payment Bond submitted by the Contractor at the time the Contract is signed.

3.04.6 CHANGES IN THE WORK

- (1) The Owner or the Engineer may, at any time, without notice to the Performance Bond or Public Works Payment Bond sureties, by written order designated or indicated to be a Change Order or Change Directive, make any change, including modifications to, additions to or deletions from the Work including, but not limited to, changes:
 - a. To the Contract Provisions and Contract Plans;
 - b. To quantities or performance of the Work;
 - c. To Owner-furnished facilities, equipment, materials, services or the Work site; or
 - d. To the schedule for the Work or the Contract Time.
- (2) A Change Order is an amendment to the Contract, which signifies changes in the scope of the Work, the Contract Time, and/or the Contract price. A Change Order shall be the complete expression of the agreement between the Owner and the Contractor. No claims or entitlement to and equitable adjustment or changes to the Contract Time and/or Contract Price will be allowed for alleged verbal or oral agreements or directives.
- (3) The Engineer will issue a written change order for any change. If the Engineer determines that the change increased or decreased the Contractor's costs or time to do any of the Work, the Engineer will make an equitable adjustment to the Contract. The equitable adjustment will be by agreement with the Contractor. However, if the parties are unable to agree, the Engineer will determine the amount of the equitable adjustment in accordance with Section 3.04.6(7) and adjust the time as

the Engineer deems appropriate. Extensions of time will be evaluated in accordance with Section 3.04.15(2).

The Contractor shall proceed with the Work upon receiving:

1. A written change order approved by the Owner; or
2. An oral order from the Engineer before actually receiving the written change order.

Within 14 calendar days of delivery of the change order the Contractor shall endorse and return the change order, request an extension of time for endorsement or respond in accordance with Section 3.04.8. The Owner may unilaterally process the change order if the Contractor fails to comply with these requirements. Changes normally noted on field stakes or variation from estimated quantities, except as provided in Section 3.04.6(8), will not require a written change order. These changes shall be made at the unit prices that apply. The Contractor shall respond immediately to changes shown on field stakes without waiting for further notice.

The Contractor shall obtain written consent of the Surety or Sureties if the Engineer requests such consent.

- (4) All Change Orders will be prepared by the Owner or Engineer and executed in triplicate with one copy to the Owner, one to the Contractor, and one retained by the Engineer.
- (5) If the Contractor encounters any circumstances during the performance of the Work that the Contractor contends creates any entitlement to a change in the Contract Time, the Contract Price, or both, the Contractor shall immediately provide written notice to the Engineer. Within 10 calendar days after providing written notice, the Contractor shall provide a written request to the Engineer for a change to the Contract Time and/or Contract Price and provide detailed information supporting the request, including cost and schedule information.
- (6) No claim by the Contractor shall be allowed if the terms of this Section 3.04.6 are not strictly followed. In the event of any non-compliance, the Contractor shall be conclusively determined to have waived any claim or entitlement to an adjustment of the Contract Time or the Contract Price.
- (7) The cost to be included in an adjustment for any changes to the Work, adjustment of the Contract Time or Contract Price and any equitable adjustment or entitlement related to the Work or the Contract shall meet the notice provisions of Section 3.04.6, and will be determined strictly by one or a combination of the following methods:
 - a. Contract unit bid prices previously agreed upon; or

- b. If there are no unit bid prices, an agreed lump sum; or
- c. If the amount of the adjustment cannot be agreed upon in advance or in the manner provided in subparagraph a or b above, the cost will be determined by the actual cost of:
 - 1. Labor including working foremen. Labor rates will only include the basic wage and fringe benefits, the current rates for Federal Insurance Compensation Act (FICA), Federal Unemployment Tax Act (FUTA) and State Unemployment Tax Act (SUTA), and the company's present rates for medical aid and industrial insurance premiums;
 - 2. Materials incorporated permanently into the Work;
 - 3. The ownership or rental cost of equipment during the time of use on the extra work. Equipment rates shall be as set forth in the then current AGC/WSDOT Equipment Rental Agreement. These rates shall be full compensation for all costs incidental to furnishing and operating the equipment. The Contractor shall submit copies of the applicable portions of the AGC/WSDOT Equipment Rental Agreement to the Engineer; plus
 - 4. Overhead and Profit as follows:

For Work performed by the Contractor, an amount to be agreed upon but not to exceed 15 percent of the labor, material, and equipment cost agreed to by the Engineer as compensation for supervision, small tools, provisions for safety, home office and field overhead, profit and other general conditions expenses, including, but not limited to, insurance, bond and business and occupation taxes.

For Subcontractor Work, the Subcontractor will be allowed an amount to be agreed upon but not to exceed 15 percent of the labor, material, and equipment cost agreed to by the Engineer as compensation for supervision, small tools, provisions for safety, home office and field overhead, profit and other general conditions expenses, including, but not limited to, insurance, bond and business and occupation taxes. The Contractor will be allowed an additional markup of 10 percent to compensate the Contractor for all administrative costs, including home office and field overhead, profit, bonding, insurance, business and occupation taxes and any other costs incurred.

In no case will the total fixed fee for the Contractor and all Subcontractors of all tiers exceed 30 percent.

- (8) Payment to the Contractor will be made only for the actual quantities of Work performed and accepted in conformance with the Contract. When the accepted quantity of Work performed under a unit item varies from the original bid quantity, payment will be at the unit Contract price for all Work unless the total accepted quantity of any Contract item, adjusted to exclude added or deleted amounts included in change orders accepted by both parties, increases or decreases by more than 25 percent from the original bid quantity, and that bid item represents 10 percent or more of the total original contract price. In that case, payment for Contract Work may be adjusted as described herein.

The adjusted final quantity shall be determined by starting with the final accepted quantity measured after all Work under an item has been completed. From this amount, subtract any quantities included in additive change orders accepted by both parties. Then, to the resulting amount, add any quantities included in deductive change orders accepted by both parties. The final result of this calculation shall become the adjusted final quantity and the basis for comparison to the original Proposal quantity.

- a. **Increased Quantities.** Either party to the Contract will be entitled to renegotiate the price for that portion of the adjusted final quantity in excess of 1.25 times the original Proposal quantity, if 10 percent or more of the original contract price. The price for excessive increased quantities will be determined by agreement of the parties, or, where the parties cannot agree, the price will be determined by the Engineer based upon the actual costs to perform the Work, including reasonable markup for overhead and profit. The final price will be determined by the Engineer.
- b. **Decreased Quantities.** Either party to the Contract will be entitled to an equitable adjustment if the adjusted final quantity of Work performed is less than 75 percent of the original Bid quantity, if 10 percent or more of the original contract price. The Contractor shall submit the documentation to support the equitable adjustment to the Engineer. The equitable adjustment shall be based upon and limited to three factors:
 1. Any increase or decrease in unit costs of labor, materials or equipment, utilized for Work actually performed, resulting solely from the reduction in quantity;
 2. Changes in production rates or methods of performing Work actually done to the extent that the nature of the Work actually performed differs from the nature of the Work included in the original plan; and
 3. An adjustment for the anticipated contribution to unavoidable fixed cost and overhead from the units representing the difference between the adjusted final quantity and 75 percent of the original Plan quantity.

The following limitations shall apply to renegotiated prices for increases and/or equitable adjustments for decreases:

1. The equipment rates shall be actual cost but shall not exceed the rates set forth in the AGC/WSDOT Equipment Rental Agreement.
2. No payment will be made for extended or unabsorbed home office overhead and field overhead expenses to the extent that there is an unbalanced allocation of such expenses among the Contract Bid items.
3. No payment for consequential damages or loss of anticipated profits will be allowed because of any variance in quantities from those originally shown in the Proposal form, Contract Provisions, and Contract Plans.
4. The total payment (including the adjustment amount and unit prices for Work performed) for any item that experiences an equitable adjustment for decreased quantity shall not exceed 75 percent of the amount originally Bid for the item.

If the adjusted final quantity of any item does not vary from the quantity shown in the Proposal by more than 25 percent, then the Contractor and the Owner agree that all Work under that item will be performed at the original Contract unit price.

When ordered by the Engineer, the Contractor shall proceed with the Work pending determination of the cost or time adjustment for the variation in quantities.

The Contractor and the Owner agree that there will be no cost adjustment for decreases if the Owner has entered the amount for the item in the Proposal form only to provide a common Proposal for Bidders.

3.04.7 DIFFERING SITE CONDITIONS

The Contractor shall promptly, and before such conditions are disturbed, notify the Engineer in writing of: (1) pre-existing subsurface or latent physical conditions at the Work site that differ materially from those indicated in the Contract Documents, or (2) pre-existing unknown physical conditions at the Work site, of an unusual nature, that differ materially from those ordinarily encountered and generally recognized as inherent in the Work of the character required by the Contract. The Engineer shall be given an opportunity to examine such conditions in order to advise the Owner of possible modifications to the Work to mitigate such conditions. If the Engineer determines that conditions are materially different and cause a material increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, an equitable adjustment shall be made in the Contract Time and/or Contract price in accordance with other

applicable provisions of the Contract relating to changes in the Work. Failure of the Contractor to give notice of such conditions at the time of discovery shall constitute a waiver of any claim for an equitable adjustment. Any such adjustments to the Contract Price shall be computed strictly limited to amounts provided under paragraph 3.04.6.

3.04.8 PROTEST BY THE CONTRACTOR

If the Contractor disagrees with anything in a Change Order or a written directive, or with any interpretation or determination by the Engineer, the Contractor shall:

- a. Immediately submit a signed written notice of protest to the Engineer before doing the Work;
- b. Supplement the written protest within 14 calendar days with a written statement and supporting documents providing the following:
 1. The date and nature of the protested order, direction, instruction, interpretation or determination;
 2. A full discussion of the circumstances which caused the protest, including names of persons involved, time, duration, and nature of the Work involved and a review of the Plans and Contract Provisions referenced to support the protest;
 3. The estimated dollar cost, if any, of the protested Work and a detailed breakdown showing how that estimate was determined; and
 4. An analysis of the progress schedule showing the schedule change or disruption if the Contractor is asserting a schedule change or disruption; and
 5. If the protest is continuing, the information required above shall be supplemented upon request by the Engineer until the protest is resolved.

The Contractor shall keep detailed and complete records of extra costs and schedule impacts to Contract Time that in any way relate to a protest. The Contractor shall allow the Engineer to have access to all documents and records needed for evaluating the protest.

The Engineer will evaluate all protests that comply with this Section. If the Engineer determines that a protest is valid, the Engineer will adjust the Contract Price and/or the Contract Time by an adjustment in accordance with Section 3.04.6 and 3.04.15(2).

During the time when any protest is pending, the Contractor shall proceed promptly with the Work, as the Engineer orders in writing.

The Contractor's failure to submit a protest in strict accordance with the requirements of this Section shall constitute a waiver of any claim for an adjustment to the Contract Time, the Contract Price, or other relief.

3.04.9 SUBCONTRACTORS AND SUBCONTRACTS

3.04.9(1) Contractor Responsibility

Nothing contained in the Contract shall create any contractual or other relationship between the Owner and/or the Engineer and any Subcontractor or sub-subcontractor, and no performance undertaken by any such Subcontractor or sub-subcontractor shall, under any circumstances, relieve the Contractor of its obligations and responsibilities under the Contract.

Prior to subcontracting any Work, the Contractor shall verify that every first tier Subcontractor meets the responsibility criteria stated below at the time of subcontract execution. The Contractor shall include these responsibility criteria in every subcontract, and require every Subcontractor to:

1. Possess any electrical contractor license required by 19.28 RCW or elevator contractor license required by 70.87 RCW, if applicable;
2. Have a certificate of registration in compliance with Chapter 18.27 RCW;
3. Have a current State unified business identifier number;
4. If applicable, have:
 - a. Industrial insurance coverage for the bidder's employees working in Washington (Title 51 RCW);
 - b. An employment security department number (Title 50 RCW);
 - c. A state excise tax registration number (Title 82 RCW).
5. Not be disqualified from bidding on any public works contract under RCW 39.06.010 or RCW 39.12.065(3);
6. Verify these responsibility criteria for every lower tier subcontractor at the time of subcontract execution; and
7. Include these responsibility criteria in every lower tier subcontract.

3.04.9(2) Contractor Work Performance Requirement

Work done by the Contractor's own organization shall account for at least 30 percent of the awarded Contract price.

3.04.9(3) Approval of Subcontractors

The Contractor shall not subcontract Work unless the Engineer approves in writing. Each request to subcontract shall be on the form the Engineer provides. If the Engineer requests, the Contractor shall provide proof that the subcontractor has the experience, ability, and equipment the work requires. The Contractor shall require each subcontractor to comply with Section 3.03.4 and to furnish all certificates and statements required by the contract. Approval of a Subcontractor by the Owner shall not relieve the Contractor or Subcontractor of any obligations or responsibilities under the Contract. Any delays or other impacts caused by the failure of the Contractor to provide required information and obtain approval of any Subcontractor in a timely manner will not be considered as justification for additional compensation or an extension of the Contract Time.

3.04.9(4) Subcontracts

Upon approval of Subcontractors by the Owner, the Contractor shall, if requested, provide the Owner with complete copies of all subcontracts entered into between the Contractor and any Subcontractor. Providing requested subcontracts to the Owner shall be a condition precedent to the Owner's obligation to make any progress payment to the Contractor.

3.04.9(5) Incorporation of Contract

Every subcontract entered into by the Contractor shall expressly bind each Subcontractor to all of the terms and conditions of the Contract, which the Contractor shall incorporate into each subcontract by reference.

3.04.9(6) Replacement of Subcontractors

Subject to the requirements of state and/or federal agencies having jurisdiction over MBE/WBE/DBE requirements applicable to the Work, should it become impossible for a Subcontractor to perform the Subcontractor's intended work, the Contractor shall submit the information required above for an alternate Subcontractor at least 10 days prior to the time that the Subcontractor is scheduled to begin work. The failure of any Subcontractor to perform its portion of the Work in a timely or workmanlike fashion is the sole responsibility of the Contractor.

3.04.10 MUTUAL RESPONSIBILITY OF CONTRACTORS

The Owner reserves the right to perform other work on or near the Work site using its own forces and/or other contractors. The Contractor shall take all reasonable steps to coordinate its performance of the Work with the Owner and/or such other contractors and subcontractors. If, through acts of commission or omission on the part of the Contractor, any other contractor or any subcontractor shall suffer loss or damage with respect to the other work being performed by the Owner, the Contractor agrees to promptly settle with such other contractor or subcontractor by agreement or other dispute resolution process. The Contractor agrees to indemnify and hold harmless the Owner and the Engineer from all claims asserted against and liability incurred by the Owner or the Engineer resulting from disputes between the Contractor and any other contractor or any subcontractor or material supplier. The indemnification rights of the Owner and the Engineer include expenses such as, but not limited to, salaries/wages of employees and all other expenses

relating to any mediation, litigation, or arbitration, including costs, consulting fees and attorneys' fees. If such other contractor or subcontractor shall assert any claim against the Owner on account of any damage alleged to have been sustained by an act or omission of the Contractor or anyone for whose acts it may be liable, the Owner or the Engineer shall notify the Contractor, which shall defend, indemnify and save harmless the Owner and the Engineer against such claim.

The coordination of the Work with other work by the Owner shall be taken into account by the Contractor as part of its site investigation obligations under Section 2.01.4, and all costs thereof shall be borne by the Contractor as part of the contract price for the Work.

3.04.11 RISK OF LOSS

The Contractor shall have all risk of loss for all Work in progress, all materials, all equipment and all other items in any way relating to the Work through theft, fire, other casualty, act of God, or any other cause until the Contract Completion Date.

3.04.12 MEASUREMENT AND PAYMENT

3.04.12(1) General

The Contract price for the Work, whether lump sum or unit prices, shall constitute full compensation for furnishing all facilities, labor, materials, appurtenances, and incidentals and performing all operations necessary to construct and complete all items of the Work in accordance with the Contract, notwithstanding that minor or incidental features of the Work may not be shown on the Contract Plans or Contract Provisions.

3.04.12(2) Measurement

Measurement for all items shall be as specified in the Contract for unit price and lump sum price items.

3.04.12(3) Payment

Payment for all of the Work will be made at the lump sum or unit contract price as set forth in the Contract. Payment of the contract price shall constitute full compensation for the complete performance of all of the Work.

3.04.12(4) Access to Books and Records

The Contractor shall, whenever so requested, give the Owner and/or the Engineer access to all invoices, bills of lading and other documents relating to the Work. The Contractor shall, without charge, provide personnel and measures and scales with adequate capacity for measuring or weighing any materials or other items paid for on a unit price basis.

3.04.12(5) Progress Payment Estimates

Progress payment estimates shall be prepared by the Engineer and reviewed by the Contractor and will be submitted with the Engineer's recommendation to the Owner for its approval on the first day of the month for all Work completed through the 26th day of the preceding month, unless otherwise agreed upon by the Owner, the Engineer and the Contractor. The Engineer will prepare progress payment estimates as accurately as available information permits. The Owner will make no payment under the Contract for the Work performed until the "Statement of Intent to Pay Prevailing Wages," in accordance with RCW 39.12.040, is submitted to the Engineer, including Subcontractor wage rates. In general, each progress payment will be based upon the payment schedule and the value of Work performed during the preceding pay period. Before the final progress payment estimate is prepared, all quantities will be reviewed by the Engineer.

3.04.12(6) Payment for Materials on Hand

The Owner may reimburse the Contractor for 90 percent of the invoice amount of materials and equipment purchased before their incorporation into the work if properly stored on or near the Work site. Invoices for equipment and materials will be verified and approved by the Engineer. Each invoice shall be sufficiently detailed to enable the Engineer to determine actual costs. Payment for materials on hand shall not exceed the total contract cost of the contract item. Payment will not be made for granular materials, forming materials, consumables, nails, tie wire, etc. Payment will not be made for materials for any invoice that is less than \$2,000.00 or for freight bills and similar items. Payment for equipment or materials on hand shall not constitute acceptance of the equipment or materials. Equipment and materials will be rejected if found to be faulty, even if payment for it has been made.

3.04.12(7) Payments Withheld

The Engineer may decide not to recommend approval of all or a portion of a progress estimate, and/or the Owner may decide to withhold from a progress estimate an amount sufficient to protect the Owner from loss because of:

- a. Defective Work not remedied;
- b. Third-party claims or reasonable evidence indicating the probability that a third-party claim will be asserted;
- c. Failure of the Contractor to make timely and proper payments to Subcontractors or for labor, materials or equipment;
- d. Reasonable evidence that the Work cannot be completed for the unpaid balance of the contract price;
- e. Damage to the Owner or another contractor;

- f. Reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance of the contract price will not be adequate to cover actual or liquidated damages for the anticipated delay;
- g. Repeated failure by the Contractor to comply with the directions of the Owner or the Engineer or to carry out the Work in accordance with the Contract;
- h. Other appropriate reasons necessary to protect the Owner.

3.04.12(8) Payment Upon Correction of Deficiencies

When the reason or reasons for withholding payment are resolved, payment will be made for amounts previously withheld.

3.04.12(9) Final Payment

After final inspection (Section 3.04.16(2)) of the Work and a determination by the Engineer that the Physical Completion Date has been achieved, the balance of the Contract price due to the Contractor will be paid based upon the final estimate by the Engineer and presentation of a Final Contract Voucher Certification signed by the Contractor. The Final Contract Voucher Certification shall be deemed to be a release of all claims of the Contractor unless a claim is filed in accordance with the requirements of Section 3.05 and is expressly excepted from release in the Contractor's Final Contract Voucher Certification. The date the Owner signs the Final Contract Voucher Certification constitutes the Contract Completion Date in accordance with Section 3.04.16(3).

If the Contractor fails, refuses, or is unable to sign and return the Final Contract Voucher Certification or any other documentation required in order to achieve the Contract Completion Date, the Owner reserves the right to establish a completion date (for the purpose of meeting the requirements of RCW 39.08 and RCW 60.28) and unilaterally accept the Work. Unilateral final acceptance will occur only after the Contractor has been provided the opportunity, by written request from the Engineer, to voluntarily submit such documents. If voluntary compliance is not achieved, formal notification of the impending establishment of a completion date and unilateral final acceptance will be provided by certified letter from the Owner to the Contractor, which will provide 30 calendar days for the Contractor to submit the necessary documents. The 30 calendar day period will begin on the date the certified letter is received by the Contractor. The date on which the Owner unilaterally signs the Final Contract Voucher Certification shall constitute the Contract Completion Date under Section 3.04.16(3). The Owner shall have the right to unilaterally establish a Contract Completion Date when either (1) the Physical Completion Date for the Work has been achieved in accordance with Section 3.04.16(2), or (2) the Owner terminates the contract in accordance with Section 3.07. Unilateral establishment of the Contract Completion Date by the Owner shall not in any way relieve the Contractor of any liability for failing to comply with the Contract or from responsibility for compliance with all federal, state, tribal, or local laws, ordinances, and regulations that affect the Work.

Payment to the Contractor of partial or final payment estimates and retained percentages shall be subject to applicable laws.

3.04.13 WORK HOURS

Except in the case of emergency or unless otherwise approved by the Owner, the normal straight time working hours for the contract shall be any consecutive 8-hour period between 7:00 a.m. and 6:00 p.m. of a working day.

3.04.14 CONTRACT TIME

The Contract Time shall begin on the first working day following the 10th calendar day after the issuance of the written Notice to Proceed or the first day on which the Contractor begins to perform Work on the site, whichever occurs first. Time is of the essence of the Contract. All of the Work shall be completed within the time limits set forth in the Contract, and the Contractor's unexcused failure to do so shall result in the assessment of liquidated damages as provided in the Contract.

The Contractor shall complete all of the physical Work within the number of calendar days that are specified as the Contract Time. Every day will be counted as a calendar day.

Each calendar day shall be charged to the Contract Time as it occurs until the physically completion date. If requested by the Contractor in writing, the Engineer will provide the Contractor with a weekly statement that shows the number of calendar days: (1) charged to the Contract Time the week before; (2) specified for the Contract Time; and (3) remaining to achieve the physical completion date. If the Contractor disagrees with any statement issued by the Engineer, the Contractor shall submit a written protest within 10 calendar days after the date of the statement. The protest shall be sufficiently detailed to enable the Engineer to ascertain the basis for the dispute and amount of time disputed. Any statement that is not protested by the Contractor as required in this Section shall be deemed as having been accepted as correct.

3.04.15 CONSTRUCTION SCHEDULE

3.04.15(1) Progress Schedule

- a. The Contractor shall submit to the Engineer one electronic copy of a progress schedule no later than at the preconstruction conference, or some other mutually agreed upon submittal time. The schedule shall be a critical path method (CPM) schedule, bar chart, or other standard schedule format unless otherwise specified in the Technical Specifications. Regardless of which format is used, the schedule shall identify the critical path. The Engineer will evaluate the schedule and return the schedule for corrections. No progress payments will be made until the required progress schedules have been submitted in a form acceptable to the Engineer.
- b. Scheduling terms and practices shall conform to the standards established in Construction Planning and Scheduling, Second Edition, published by the Associated General Contractors of America. Except for Weekly Look-Ahead Schedules, all schedules shall meet these general requirements, and provide the following information:

- i. Show the construction start date.
- ii. Include all activities necessary to physically complete the project.
- iii. Show the planned order of Work activities in a logical sequence.
- iv. Show the durations of Work activities in working days as defined in Section 3.04.13 and 3.04.14.
- v. Show activities in durations that are reasonable for the intended Work.
- vi. Define activity duration in sufficient detail to evaluate the progress of individual activities on a daily basis.
- vii. Show the Substantial and Physical Completion of all Work within the Contract Time.

Total float belongs to the project and shall not be for the exclusive benefit of any party. If the Engineer determines that the Progress Schedule or any necessary Schedule Update does not provide the required information, then the schedule will be returned to the Contractor for correction and resubmittal.

- c. Each week the Work is performed, the Contractor shall submit a Weekly Look-Ahead Schedule showing the Contractor's and all the Subcontractors' proposed Work activities for the next two weeks. The Weekly Look Ahead Schedule shall include the description, duration and sequence of Work, along with the planned hours of Work. This schedule may be network schedule, bar chart, or other standard schedule format. The Weekly Look-Ahead Schedule shall be submitted to the Engineer by the mid-point of the week preceding the scheduled Work or some other mutually agreed upon submittal time.
- d. The Engineer may request a Schedule Update when any of the following events occur:
 - i. The project has experienced a change that affects the critical path.
 - ii. The sequence of Work is changed from that in the approved schedule.
 - iii. The project is significantly delayed.
 - iv. Upon receiving an extension of Contract time.

The Contractor shall submit one electronic copy of the Schedule Update within 15 calendar days of receiving a written request, or when an update is required by any other portion of the Contract. A "significant" delay in time is defined as 10 working days or 10 percent of the original Contract time, whichever is greater.

In addition to the other requirements in this Section, Schedule Updates shall reflect the following information:

- i. The actual duration and sequence of as-constructed Work activities, including changed Work.
- ii. Approved time extensions.
- iii. Any construction delays or other conditions that affect the progress of the Work.
- iv. Any modifications to the as-planned sequence or duration of remaining activities.
- v. The Substantial and Physical Completion of all remaining Work in the remaining Contract time.

Unresolved request for time extensions shall be reflected in the Schedule Update by assuming no time extension will be granted, and by showing the effects to follow-on activities necessary to substantially and physically complete the project within the currently authorized time for completion.

- e. The original Progress Schedule and all Schedule Updates shall not conflict with any time and order-of-work requirement in the Contract.
- f. If the Engineer deems that the original or any necessary supplemental progress schedule does not provide the information required in this section, the Owner may withhold progress payments until a schedule containing the required information has been submitted by the Contractor and accepted by the Engineer.
- g. The Contractor shall comply with other progress schedule requirements that are further defined in the Specifications.
- h. The Engineer's approval of any schedule shall not transfer any of the Contractor's responsibilities to the Owner. The Contractor alone shall remain responsible for adjusting forces, equipment, and work schedules to ensure completion of the work within the time(s) specified in the Contract.

3.04.15(2) Extensions of the Contract Time

- a. The Contractor specifically waives claims for damages for any hindrance or delay, excepting unreasonable delays caused by the Owner. In lieu thereof, the Contractor will be granted equitable extensions of the Contract Time for which liquidated damages will not otherwise be claimed by the Owner under the following circumstances:

- i. A delay caused by any suit or other legal action against the Owner will entitle the Contractor to an equivalent extension of time, unless the period of such delay exceeds 90 calendar days. When such period is exceeded, the Owner will, upon written request of the Contractor, either negotiate a termination of the Contract or grant a further extension of the Contract Time, whichever is in the best interests of the Owner.
- ii. Should any other unforeseen condition occur that is beyond the reasonable control of Contractor, requires more time for the Contractor to complete the performance of the Work by the Substantial Completion Date, the Contractor shall notify the Owner and the Engineer in writing prior to the performance of such Work, and in any event within 10 calendar days after the occurrence of the unforeseen condition. The notice shall set forth in detail the Contractor's estimate of the required time extension. The Owner will allow such equitable extension of the Contract Time that the Engineer determines to be appropriate. Failure to comply with the notice provisions required by the Contract shall be deemed a complete waiver of any entitlement to adjustment of the Contract Time.

3.04.15(3) Liquidated Damages

- a. The Contractor acknowledges that the Owner will suffer monetary damages in the event of an unexcused delay in the Substantial Completion Date and the Physical Completion Date of the Work. If the Contractor fails, without excuse under the Contract, to complete the Work within the Contract Time, or any proper extension thereof granted by the Owner, the Contractor agrees to pay to the Owner the amount specified in the Proposal form, not as a penalty, but as liquidated damages for such breach of the Contract, for each day that the Contractor shall be in default after the time stipulated for the Substantial Completion Date and the Physical Completion Date of the Work.
- b. The amount of liquidated damages is fixed and agreed upon by and between the Contractor and the Owner because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the Owner would in such event sustain, and said amount is specifically agreed to be a reasonable approximation of damages that the Owner would sustain as a result of an unexcused delay in the Substantial Completion Date and the Physical Completion Date; said amount may be retained from time to time by the Owner from current progress payments.

3.04.16 COMPLETION AND ACCEPTANCE OF THE WORK

3.04.16(1) Substantial Completion Date

- a. When the Contractor considers the Work to be substantially complete and ready for its intended purpose, the Contractor shall notify the Engineer in writing and include an itemized list of remaining Work to be completed. On the Substantial Completion Date, the Owner shall have full and unrestricted use and benefit of all of the

facilities that comprise the Work, both from an operational and safety standpoint, with only minor incidental work, replacement of temporary substitute facilities, or correction or repair of work remaining for the physical completion of the total Work.

- b. If the Engineer determines that the Work is not substantially complete, it will so notify the Contractor in writing identifying those items of the Work that shall be completed by the Contractor in order to achieve the Substantial Completion Date.
- c. If the Engineer believes that the Work is substantially complete, the Engineer will meet with the Contractor to: (1) prepare a list of incomplete or unsatisfactory items of the Work that shall be completed or corrected; (2) define the division of responsibility between Owner and Contractor with respect to security, operation, maintenance, heat, utilities, insurance, etc., for the facilities; and (3) describe any other issues related to approval of the substantially completed Work. Upon reaching agreement with the Contractor, the Engineer will notify the Owner that, in its opinion and based on the information supplied by the Contractor, the Work is substantially complete, listing the items of incomplete Work, defining the division of responsibilities for the facilities, and setting forth any other terms related to final completion and acceptance.
- d. The Owner, who has sole authority to make the determination of the Substantial Completion Date, will review the Engineer's recommendation that the Work is substantially complete and, if it concurs, will instruct the Engineer to notify the Contractor that the Work is accepted as being substantially complete. Except for any portion(s) of Work specified for early completion or required by the Owner for early possession, substantial completion will not occur for any portion of the Work until the entire Work is ready for possession and use. The approval notice will include a list of incomplete Work items, establish the Substantial Completion Date, and describe any other terms relating to such approval. The Contractor shall acknowledge receipt of the approval notice in writing, indicating acceptance of all of its terms and provisions.
- e. The date of Substantial Completion, as determined by the Engineer and agreed to by the Owner, shall be the date for the beginning of the warranty period.
- f. Subsequent to the Substantial Completion date, the Owner may exclude the Contractor from the Work during such periods when construction activities might interfere with the operation of the Project. The Owner, however, shall allow the Contractor reasonable access for completion of incomplete punch list items.

3.04.16(2) Physical Completion Date

- a. The Contractor shall complete all physical Work within the Contract Time.
- b. Upon physical completion of the Work, including completion of all corrective Work described in Section 3.04.16(1) above and the submission of all required

record drawings, operation and maintenance manuals, manufacturers' affidavits, software and programming, and other items required by the Contract, the Contractor shall notify the Engineer in writing that the Work is physically complete. Upon receipt of the notification, the Engineer will determine if the Work is physically complete in accordance with the Contract. If the Engineer determines that any materials, equipment, or workmanship do not meet the requirements of the Contract, the Engineer will prepare a list of such items and submit it to the Contractor. Following the satisfactory completion of the corrective Work by the Contractor, the Engineer will notify the Owner that the Work is physically complete in accordance with the requirements of the Contract.

- c. The Engineer, with the concurrence of the Owner, will give the Contractor written notice of the Physical Completion Date for all of the Work. The Physical Completion Date shall not constitute the Owner's acceptance of the Work.

3.04.16(3) Contract Completion Date (Acceptance of the Project)

- a. When all of the Contractor's obligations under the Contract have been performed satisfactorily, the Owner will provide the Contractor with written notice of the Contract Completion Date. The following events shall occur in order for the Contractor to achieve the Contract Completion Date:
 - 1. The Contractor shall have achieved the Substantial Completion Date and the Physical Completion Date for the Work; and
 - 2. The Contractor shall furnish all documentation required by the Contract and required by law. The documents shall include, but are not limited to, the following:
 - i. Complete and legally effective releases and/or waivers of liens or bond or retainage claims in a form acceptable to the Owner. Subject to prior approval of the Owner, the Contractor may, if approved by the Owner, submit in lieu of the lien or claims releases and waivers: (1) receipts showing payment of all accounts in full; (2) an affidavit that the release and receipts cover all labor, services, materials, and equipment for which a lien or other claim could be filed and that all payrolls, material, and equipment bills and other indebtedness connected with the Work for which the Owner or the Owner's property might in any way be responsible, have been paid; and (3) the consent of the surety, if any, to final payment. If any Subcontractor or supplier fails to furnish a release waiver or receipt in a form satisfactory to the Owner, the Contractor may be permitted by the Owner to furnish a bond or other collateral satisfactory to the Owner to indemnify the Owner against any lien or similar claim;
 - ii. Certified Payrolls (Federal Aid projects or if requested);

- iii. Final Contract Voucher Certification.
 - iv. Affidavits of Wages Paid for the Contractor and all subcontractors must be submitted to the Owner.
- b. The Contractor agrees that neither completion nor final acceptance shall relieve the Contractor of the responsibility to indemnify, defend, and protect the Owner against any claim or loss resulting from the failure of the Contractor (or the subcontractors or lower tier subcontractors) to pay all laborers, mechanics, subcontractors, materialpersons, or any other person who provides labor, supplies, or provisions for carrying out the work or for any payments required for unemployment compensation under Title 50 RCW or for industrial insurance and medical aid required under Title 51 RCW.

Final acceptance shall not constitute acceptance of any unauthorized or defective work or material. The Owner shall not be barred from requiring the Contractor to remove, replace, repair, or dispose of any unauthorized or defective work or material or from recovering damages for any such work or material.

3.04.16(4) Use of Completed Portions of the Work

The Owner reserves the right to use and occupy any portion of the Work which has been completed sufficiently to permit partial use and occupancy, and such partial use and occupancy shall not be construed as an acceptance of the Work as a whole or any part thereof. Any claims that the Owner may have against the Contractor shall not be deemed to have been waived by such partial use and occupancy.

3.04.16(5) Waiver of Claims by Contractor

The Contractor's acceptance of the final payment from the Owner constitutes an irrevocable and complete waiver of any and all claims against the Owner under the Contract or otherwise arising from the Work, except for those claims that have been properly identified in writing in advance of final payment, and for which timely and sufficient prior written notice has been given, all in accordance with the Contract.

3.04.17 CORRECTION OF FAULTY WORK AFTER FINAL PAYMENT

The Owner's final payment to the Contractor shall not relieve the Contractor of responsibility for faulty materials, equipment or workmanship. The Contractor shall promptly repair or replace any such defects discovered within the warranty or other applicable limitations period.

3.04.18 RETAINAGE

1. Pursuant to RCW 60.28, there will be retained from monies earned by the Contractor on progress estimates a sum not to exceed 5 percent of the monies earned by the Contractor. Such retainage shall be used as a trust fund for the protection and payment (1) to the State with respect to taxes imposed pursuant to

RCW Title 82, which may be due from such Contractor, and (2) the claims of any other person or entity arising under the Contract or RCW 60.28.

2. Monies retained pursuant to RCW 60.28 shall, at the option of the Contractor, be:
 - a. Retained in a fund by the Owner;
 - b. Deposited by the Owner in an interest-bearing account in a bank, mutual savings bank, or savings and loan association (interest on monies so retained may be paid to the Contractor);
 - c. Deposited by the Owner in an escrow (interest-bearing) account in a bank, mutual saving bank, or savings and loan association (interest on monies so retained shall be paid to the Contractor). Deposits are to be in the name of the Owner and are not to be allowed to be withdrawn without the Owner's written authorization. The Owner will issue a check representing the sum of the monies reserved, payable to the bank or trust company;
 - d. In choosing option (b) or (c), the Contractor agrees to assume full responsibility to pay all costs which may accrue from escrow services, brokerage charges or both, and further agrees to assume all risks in connection with the investment of the retainage in securities.

At the time the Contract is executed the Contractor shall designate the option desired.

3. Release of retainage will be made within the statutory period following the last date for filing of claims pursuant to RCW Chapter 60.28, provided that the following conditions are met:
 - a. A release has been obtained from the Washington State Department of Revenue;
 - b. A "Certificate of Payment of Contributions Penalties and Interest on Public Works Contract" is received from the Washington State Employment Security Department;
 - c. The Washington State Department of Labor and Industries indicates the Contractor is current on the payment of industrial insurance and medical aid premiums;
 - d. All claims by the Owner against the Contractor have been resolved;
 - e. No claims have been filed against the retained percentage;
 - f. All required "Affidavits of Wages Paid" are on file with the Owner for the Contractor and all Subcontractors, regardless of tier;

4. In the event that claims are filed against the retainage, the Contractor will be paid the retained percentage less an amount sufficient to pay all such claims, together with a sum determined by the Owner to be sufficient to pay the costs of foreclosing on claims and to attorneys' fees, all in accordance with applicable law.

3.05 DISPUTES AND CLAIMS

3.05.1 DISPUTES

When disputes occur, the Contractor shall pursue resolution through the Engineer. The Contractor shall follow the notice and protest procedures outlined in Section 3.04. If negotiation using the procedures outlined in Section 3.04 fails to provide satisfactory resolution, the Contractor shall pursue the more formalized method set forth in Section 3.05.2 for submitting claims.

3.05.2 CLAIMS

If the Contractor contends that additional payment is due, has provided timely notices and protests as required by Section 3.04, and the Contractor has pursued and exhausted all of the means provided in that section to resolve the dispute, the Contractor may submit a claim as provided in this Section. Any claim for an increase in the Contract Price or for an extension of the Contract Time by the Contractor is waived if the written notifications and protests required in Section 3-04 have been not provided, or if the Engineer is not afforded reasonable access to the Contractor's complete records relating to the claim, as required by Section 3-04.8, or if a claim is not submitted in accordance with the requirements of this Section. The fact that the Contractor has provided proper notification, properly submitted a claim, or provided the Engineer with access to records, shall not in any way be construed as proving or substantiating the validity of the claim. If, after consideration by the Owner, the claim is found to have merit, the Owner will make an equitable adjustment to either the Contract Price, the Contract Time, or both. If the Owner finds the claim to be without merit, no adjustment will be made.

All claims submitted by the Contractor shall be in writing and in sufficient detail to enable the Engineer to ascertain the basis for and amount of the claim. All claims shall be submitted to the Engineer in the manner in Section 3.03.6. The following information shall accompany each claim submitted:

1. A detailed factual statement of the basis for the claim for additional compensation and/or extension of time, including all relevant dates, locations, and items of work relating to the claim.
2. The date on which the events occurred that give rise to the claim.
3. The name of each person involved in or having knowledge about the claim.
4. The specific provisions of the Contract which support the claim and a statement of the reasons why such provisions support the claim.

5. If the claim relates to a decision of the Engineer that the Contract leaves to the Engineer's discretion or as to which the Contract provides that the Engineer's decision is final, the Contractor shall set out in detail all facts supporting its position relating to the decision of the Engineer.
6. The identification of any documents and the substance of any oral communications that support the claim.
7. Copies of any identified documents, other than Owner documents and documents previously furnished to the Owner by the Contractor, that support the claim (manuals which are standard to the industry may be included by reference).
8. If an extension of the Contract Time is sought:
 - a. The specific days and dates for which the extension is sought;
 - b. The specific reasons why the Contractor believes a time extension should be granted;
 - c. The specific provisions of Section 3-04.15(2) under which the time extension is sought; and
 - d. An analysis of the Contractor's progress schedule, demonstrating the reasons why a time extension should be granted.
9. If additional compensation is sought, the exact amount sought and a breakdown of that amount into the following categories:
 - a. Labor;
 - b. Materials;
 - c. Direct equipment. The actual cost for each piece of equipment for which a claim is made, or, in the absence of actual cost, the rates established by the AGC/WSDOT Equipment Rental Agreement which was in effect when the Work was performed. The amounts claimed for any piece of equipment shall not exceed the rates established by the Equipment Rental Agreement, even if the actual cost for such equipment is higher. The Owner may audit the Contractor's cost records, as provided in Section 3.06, to determine actual equipment costs. The following information shall be provided for each piece of equipment:
 - i. Detailed description (e.g., make, model, year, diesel or gas, size of bucket);
 - ii. The hours of use or standby; and
 - iii. The specific day and dates of use or standby.
 - d. Subcontractor claims (in the same level of detail as specified herein); and

e. Other information as requested by the Engineer or the Owner.

10. A notarized statement containing the following language:

Under the penalty of law for perjury or falsification, the undersigned,

_____,
(name) (title)

of _____
(company)

hereby certifies that the claim for extra compensation and time, if any, made herein for work on this Contract is a true statement of the actual costs incurred and time sought, and is fully documented and supported under the contract between the parties.

Dated _____/s/ _____

Subscribed and sworn before me this _____ day of _____

Notary Public

My Commission Expires: _____

It will be the responsibility of the Contractor to keep full and complete records of the costs and additional time incurred with respect to any claim. The Contractor shall permit the Engineer to have access to those records and any other records and documents as may be required by the Engineer to determine the facts or contentions involved in the claim. The Contractor shall retain all records and documents in any way relating to the Work for a period of not less than three years after the Contract Completion Date.

The Contractor shall in good faith attempt to reach a negotiated resolution of all claims with the Engineer or its designee.

The Contractor's failure to submit with the Final Contract Voucher Certification a list of all claims, together with the information and details required by this Section shall operate as a waiver of the claims by the Contractor, as provided in Section 3.04.12(9).

If the Contractor submits a claim in full compliance with all the requirements of this Section, the Owner will respond in writing to the claim as follows:

1. Within 45 calendar days from the date the claim is received by the Owner, if the claim amount is less than \$100,000;

2. Within 90 calendar days from the date the claim is received by the Owner, if the claim amount is equal to or greater than \$100,000; or
3. If these time periods are unreasonable due to the complexity of the claim, the Contractor will be notified within 15 calendar days from the date the claim is received by the Owner of the amount of time which will be necessary for the Owner to evaluate the claim and issue a response.

Full compliance by the Contractor with the provisions of this Section is a condition precedent to the Contractor's right to seek commence a lawsuit or pursue other legal remedies.

3.05.3 TIMELINE AND JURISDICTION

For the convenience of the parties to the Contract it is mutually agreed by the parties that any claims or causes of action which the Contractor has against the Owner arising from the Contract shall be brought within 180 calendar days from the date of Physical Completion (Section 3.04.16(2)) of the Contract by the Owner; and it is further agreed that any such claims or causes of action shall be brought only in the Superior Court of the county where the Owner headquarters is located, provided that where an action is asserted against a county, RCW 36.01.05 shall control venue and jurisdiction. The parties understand and agree that the Contractor's failure to bring suit within the time period provided, shall be a complete bar to any such claims or causes of action. It is further mutually agreed by the parties that when any claims or causes of action which the Contractor asserts against the Owner arising from the Contract are filed with the Owner or initiated in court, the Contractor shall permit the Owner to have timely access to any records deemed necessary by the Owner to assist in evaluating the claims or action.

3.05.4 CONTINUATION OF WORK PENDING RESOLUTION OF DISPUTES

The Contractor shall expeditiously carry on the Work, adhere to the progress schedule, and comply with all written directives of the Owner or the Engineer regardless of any dispute or claim that may exist between the Owner and the Contractor. No Work shall be delayed or postponed pending resolution of any dispute or claim. Failure or refusal of the Contractor to comply with the written directives of the Owner or the Engineer shall constitute a material breach of the Contract and immediately constitute grounds for the Owner to withhold payments to the Contractor, suspend the Work or terminate the Contract. Notice under this Section shall be in accordance with other provisions of the Contract.

3.06 NOT USED

3.07 SUSPENSION OF WORK AND TERMINATION OF CONTRACT

3.07.1 SUSPENSION OF WORK

1. The Owner or the Engineer may order suspension of all or any part of the Work if:
 - a. Unsuitable or other conditions that are beyond the reasonable control of the Contractor exist or arise that prevent satisfactory and timely performance of the Work; or
 - b. The Contractor does not comply with the Contract; or
 - c. It is in the public interest.
2. If the Engineer determines that the suspension is for reasons set forth in Subsection a. or c. above, an equitable adjustment will be made in the Contract Time but not the Contract price. If the Engineer determines that the suspension is for reasons set forth in Subsection b. above, no adjustment shall be made in the Contract Time or the Contract Price.
3. If the Contract is suspended for reasons set forth in Subsection a. or c. above and the Contractor believes that the suspension of performance of all or part of the Work has continued for an unreasonable period of time, the Contractor shall give written notice to the Engineer of its intention to seek an equitable adjustment in the Contract Time or the Contract price. In the event that an equitable adjustment is allowed, no adjustment shall be allowed for any time lost or costs incurred more than 10 calendar days before delivery of the written notice to the Engineer. No profit of any kind will be allowed on any increase in costs due to the suspension, delay or interruption.

3.07.2 TERMINATION FOR DEFAULT

1. The Owner may terminate the Contract for default, effective seven days following delivery of written notice of default to the Contractor, if the Contractor:
 - a. Refuses or fails to supply enough properly skilled laborers or conforming materials to complete the Work in a timely manner;
 - b. Refuses or fails to prosecute the Work with such diligence as will ensure its physical completion by the Physical Completion Date;
 - c. Performs work which deviates from the requirements of the Contract and refuses or fails to correct the non-conforming work;
 - d. Fails to make prompt payment to Subcontractors and/or suppliers for labor or materials;

- e. Fails to comply with laws, ordinances, rules, regulations or orders of a public authority having jurisdiction; or
 - f. Otherwise fails to follow written directives of the Owner or the Engineer or is in default of a material provision of the Contract.
2. If the Contractor abandons the Work for any cause other than failure of the Owner to make monthly progress payments for Work properly performed, or if the Contractor refuses to comply with requirements of the Contract, the Owner has the additional right to notify the Contractor's performance bond surety and require the surety to complete the Work in accordance with the Contract.

3.07.3 TERMINATION FOR CONVENIENCE OF THE OWNER

The Owner may by written notice terminate the Contract at any time in whole or in part, without cause, and except where termination is due to the Contractor's default, the Owner shall pay the Contractor that portion of the Contract price corresponding to the acceptable Work completed to the Owner's satisfaction, together with reasonable costs, as determined in the sole discretion of the Owner, necessarily incurred by the Contractor in terminating the remaining portion of Work, less any payments made before termination. In no event shall the Owner be required to pay the Contractor any amount in excess of the completed portion Contract price. The Owner shall not be required to pay the Contractor any amount for consequential damages including but not by means of limitation lost or anticipated profits on Work that is not performed as a result of termination.

3.07.4 RESPONSIBILITY OF THE CONTRACTOR AND SURETY

Termination of the Contract shall not relieve the Contractor of any responsibilities under the Contract for Work performed. Nor shall termination of the Contract relieve the sureties of their obligations under the bonds required or permitted by the Contract or applicable law.

PART 4

TECHNICAL SPECIFICATIONS

TECHNICAL SPECIFICATIONS

TABLE OF CONTENTS

SECTION	DESCRIPTION	PAGE
Division 1	General Technical Requirements	
01110	Summary of Work.....	01110-1
01150	Surveys	01150-1
01160	Regulatory Requirements	01160-1
01200	Measurement and Payment.....	01200-1
01290	Schedule of Values.....	01290-1
01300	Submittals	01300-1
01310	Project Meetings	01310-1
01400	Quality Control	01400-1
01500	Temporary Facilities	01500-1
01505	Mobilization and Demobilization	01505-1
01720	Record Drawings.....	01720-1
01740	Cleanup.....	01740-1
01800	Testing, Commissioning, and Training	01800-1
Division 2	Sitework	
02050	Locate Existing Utilities	02050-1
02230	Clearing and Grubbing	02230-1
02250	Temporary Shoring and Bracing.....	02250-1
02300	Earthwork	02300-1
02370	Erosion Control.....	02370-1
02500	Water Distribution.....	02500-1
02510	Disinfection.....	02510-1
02511	Connection to Existing System.....	02511-1
02530	Utility Structures	02530-1
02700	Gravel Materials.....	02700-1
02710	Gravel Surfacing	02710-1
02820	Chain Link Fence and Gate	02820-1
02900	Landscaping	02900-1
Division 3	Concrete	
03200	Concrete Reinforcement	03200-1
03300	Cast-in-Place Concrete	03300-1
Divisions 4 through 5		
Not Used		
Division 6	Wood and Plastics	
06100	Rough Carpentry	06100-1

SECTION	DESCRIPTION	PAGE
Division 7	Thermal and Moisture Protection	
07210	Batt and Rigid Insulation.....	07210-1
07410	Metal Roof and Wall Panels.....	07410-1
07900	Caulking and Sealants	07900-1
Division 8	Doors and Windows	
08110	Hollow Metal Doors and Frames.....	08110-1
08310	Metal Access Hatches	08310-1
08700	Finish Hardware.....	08700-1
Division 9	Finishes	
09900	Painting.....	09900-1
Division 10	Specialties	
Not Used		
Division 11	Equipment	
11000	Equipment General Provisions	11000-1
11010	Vibration and Critical Speed Limitations.....	11010-1
11265	Skid-Mounted Booster Pump Station.....	11265-1
Division 12	Furnishings	
Not Used		
Division 13	Special Construction	
13212	Concrete Reservoir.....	13212-1
13419	Pressure Transmitters	13419-1
13422	Float Switches.....	13422-1
Division 14	Conveying Systems	
Not Used		
Division 15	Mechanical	
15050	Piping Systems.....	15050-1
15066	Pipe and Conduit Support System	15066-1
15100	Valves	15100-1
15700	Heating, Ventilation, and Air Conditioning	15700-1

SECTION	DESCRIPTION	PAGE
Division 16	Electrical	
16050	Basic Electrical Materials and Methods	16050-1
16060	Grounding and Bonding	16060-1
16120	Conductors and Cables	16120-1
16130	Raceway and Boxes	16130-1
16140	Wiring Devices	16140-1
16210	Electrical Utility Services	16210-1
16230	Generator Assemblies	16230-1
16410	Enclosed Switches, Fuses, and Circuit Breakers	16410-1
16415	Transfer Switches	16415-1
16440	Panelboards	16440-1
16510	Interior Luminaires	16510-1
16520	Exterior Luminaires	16520-1

DIVISION 1

GENERAL TECHNICAL REQUIREMENTS

SECTION 01110

SUMMARY OF WORK

PART 1 GENERAL

1.1 SCOPE OF WORK

The work specified in this Section consists of furnishing all labor, materials, and equipment necessary for construction of the Vuecrest Water System Improvements – Reservoir and Booster Pump Station, as shown on the Plans. Work shall include, but not be limited to, the following:

Base Bid

- A. Construction of a new 87,000-gallon concrete reservoir and associated piping.
- B. Construction of an access driveway to the site.
- C. Installation of an inlet vault and associated site piping, with connection to the reservoir inlet and outlet, and drain piping to catch basins.
- D. Construction of a new booster pump station enclosure with packaged pump station, including associated site piping and connect to existing water system.
- E. Electrical, instrumentation, and telemetry work for communication between existing well, new reservoir and new pump station.
- F. Installation of on-site emergency generator.
- G. Decommissioning of existing reservoir and booster station facilities.
- H. Site grading, gravel surfacing, and site restoration.

Additive A

- A. Installation of additional site piping and valving to construct a manually-operated intertie between the Vuecrest Water System and Union Ridge Water System.
- B. Demolition of existing reservoir and booster station facilities.
- C. Installation of fencing and gates at new reservoir and booster station site.

1.2 PROJECT INFORMATION

The Contract Documents show the location, arrangement, and type of work to be performed under the proposed project.

The Contractor shall be responsible for proper notification to and coordination with all utility districts, service districts, and all other persons and services that will be affected by this project at least one week in advance of beginning any construction that affects them. The existing booster station and reservoir facilities shall remain functional throughout the construction of the new facilities and shall only be decommissioned/demolished following completion of, startup, and acceptance of the new facilities.

It is the intent and purpose of these Contract Documents to have constructed complete facilities in good working order for the least practical cost to the Owner. Suggestions, recommendations, as well as inquiries from the Contractor that will serve this purpose are welcome and will be given consideration by the Owner and the Engineer.

1.3 CONTRACTOR USE OF SITE AND PREMISES

Construction operations shall be limited to the areas noted on the Plans and subject to the approval of the Engineer.

The Contractor shall submit a traffic control plan for all site access and egress routes for construction vehicle traffic per Section 01950.

The Contractor shall allow representatives of the Owner, funding, and regulatory agencies access to the project site at all times.

The Contractor shall notify the Owner (or other water utility purveyor) at least 48 hours in advance of any proposed water system shut downs. The Contractor shall also be responsible for notifying all impacted water users 48 hours in advance of any water shutoff.

1.4 ORDER OF WORK

The order of work will be at the option of the Contractor, except as noted below, in keeping with good construction practice, time restrictions, requirements of the permits applicable to this project, and the order of work as outlined herein, all costs of which shall be included in the various bid amounts. The Contractor shall conduct the order of work to allow the existing facilities to remain operational during the construction of the Project and shall coordinate all of their activities through the Engineer with the Owner's operations and maintenance staff. The

Contractor shall provide a written plan of activities to the Engineer and Owner each Thursday for the following week, for review and coordination with existing facility operations.

The implementation of any measure required to protect the environment shall supersede any order of work designated within these Specifications. The Contractor shall meet the conditions as outlined in any and all permits and requirements of the Federal, State, County, and City regulatory agencies.

The Contractor shall keep the disruption of the existing facility operations to a minimum. Water system shutdowns shall be limited to 8 hours during any 24-hour period. The existing booster station and reservoir facilities shall remain functional throughout the construction of the new facilities and shall only be decommissioned/demolished following completion of, startup, and acceptance of the new facilities.

Access to the existing operations areas shall be maintained. Disruption of this access shall be kept to a minimum and must be prearranged and scheduled through the Engineer with the Owner's operations and maintenance staff.

The following summary shall be used as a general guideline of the construction tasks to be performed. The tasks are generally listed in the order of completion. The tasks, however, can be completed in a different order than listed herein, including performance of two or more tasks concurrently. The Contractor shall prepare a complete project schedule, which shall be provided in accordance with the limitations specified herein.

- A. Install erosion control and traffic control measures.
- B. Construct new reservoir and booster pump station.
- C. Disinfect, flush, test, and commission new reservoir and booster pump station.
- D. Complete startup, commissioning and training.
- E. Connect new intertie.
- F. Decommission and demolish existing reservoir and booster station.

Additive A will be awarded if funds are available.

***** END OF SECTION *****

SECTION 01150

SURVEYS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes all survey for the project. The Contractor shall provide all construction survey for the Work. The Engineer will provide primary horizontal and vertical control data and monuments, as shown on the Plans.

At the Contractor's request, the Engineer will provide the Plans in electronic format. Electronic files are provided for the Contractor's convenience and are not part of the Contract. Calculations shall be made from the Plans.

During the prosecution of the work, the Contractor shall make all necessary measurements to prevent misfitting, and shall be responsible for the accurate construction of the work.

1.2 DEFINITIONS

The meaning of words and terms used in this provision shall be as listed in "Definitions of Surveying and Associated Terms" current edition, published by the American Congress on Surveying and Mapping, and the American Society of Civil Engineers.

1.3 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01720	Record Drawings

1.4 QUALIFICATIONS

The Contractor shall employ a Professional Land Surveyor (PLS) registered in the State of Washington and acceptable to the Owner. All surveying shall be completed by or under the direct supervision of the PLS.

1.5 SUBMITTALS

The Contractor shall submit the name, address, and license number of the Professional Land Surveyor before starting construction.

1.6 QUALITY ASSURANCE

The Contractor shall ensure a surveying accuracy within the following tolerances:

	<u>Vertical</u>	<u>Horizontal</u>
Slope Stakes	±0.1 feet	±0.10 feet
Subgrade Grade Stakes Set 0.04 foot Below Grade	±0.01 feet	±0.5 feet (parallel to alignment) ±0.1 feet (normal to alignment)
Stationing on Roadway	N/A	±0.1 feet
Alignment on Roadway	N/A	±0.04 feet
Surfacing Grade Stakes	±0.01 feet	±0.1 foot (parallel to alignment) ±0.1 feet (normal to alignment)
Roadway Paving Pins for Surfacing or Paving	±0.01 feet	±0.1 feet (parallel to alignment) ±0.05 feet (normal to alignment)
Alignment of sewer and storm manholes and catch basins	±.01 feet	±0.1 feet
Stationing on Structures		±.02 feet
Alignment on structures		±.02 feet
Superstructure elevations	±.01 feet variation from Plan elevation	
Substructure	±.02 feet variation from Plan grades	

When the following items are included in the project, the Contractor shall perform independent checks from different secondary control to ensure that the points staked are within the specified survey accuracy tolerances:

- Piles
- Shafts
- Footings
- Columns

The Owner may spot-check the Contractor's surveying. These spot-checks will not change the requirements for accuracy by the Contractor

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

The Contractor's PLS shall establish all secondary survey controls, horizontal and vertical, as necessary to assure proper placement of all Work based upon the primary control points provided by the Owner. The Contractor shall be responsible for setting, maintaining, and resetting all alignment stakes, clearing limit stakes, slope stakes, and grades for the Work. Except for the survey control data to be furnished by the Owner, calculations, surveying, and measuring required for setting and maintaining the lines and grades shall be the Contractor's responsibility.

Survey records shall be maintained by the Contractor's PLS, including a description of the work performed on each shift, the methods utilized, and the control points used. The record shall be adequate to allow the survey to be reproduced. A copy of each day's record shall be provided to the Engineer within three working days of Engineer's request.

All surveyed points shall be established by placing hubs and tacks with marked stakes in unpaved areas or P.K. nails with painted markings in paved areas. All surveying stakes shall be marked in accordance with WSDOT Standard Plan A-10.10-00. When stakes are needed that are not described in the Standard Plans, then those stakes shall be marked as ordered by the Engineer. The Contractor's surveyor shall maintain and replace survey hubs, stakes, nails and markings immediately if destroyed, removed, or the Engineer determines the stake or pavement markings are illegible.

For monuments to be removed or destroyed as shown on the Plans, the Contractor's PLS shall file all required permit forms with the Department of Natural Resources (DNR), as required by RCW 58.09.130 and WAC 332-120.

The form "Application for Permit to Remove or Destroy a Survey Monument" shall be signed by the PLS, and submitted directly to DNR and the Owner. No work affecting monumentation shall commence until DNR has approved the permit. The form "Completion Report for Monument Removal or Destruction" shall be signed by the PLS and submitted to DNR and the Owner upon completion of work affecting monumentation.

The Contractor shall be responsible for locating and preserving existing monuments within the right-of-way, which shall include existing property corners on the right-of-way lines. In the event the Contractor disturbs or destroys any survey marker, monument, or property corner during the course of construction, not indicated to be removed on the Plans, the Contractor shall bear all costs or survey, resetting, legal claims and filing state forms as required by RCW 58.09.130 and WAC 332-120.

***** END OF SECTION *****

SECTION 01160

REGULATORY REQUIREMENTS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section contains information pertaining to permits and licenses, and use of private property.

1.2 PERMITS AND LICENSES

Except as noted below, the Contractor shall be responsible for obtaining and paying all fees associated with all the necessary permits, licenses, approvals, and construction permits necessary for the execution of this Contract, whether they be City, County, State, or federal permits.

The Owner is in possession of, or will be responsible for obtaining the following approvals and permits, and will pay the fees associated with the application and procurement of such approvals and permits. The Contractor is advised to become familiar with these approvals and permits as necessary for this project. The Contractor shall comply with all conditions of each approval/permit as if the conditions were detailed herein. Copies of these permits are required to be onsite at all times.

- A. Washington State Department of Health Project Approval
- B. Mason County Site Development Permit
- C. Mason County Building Permit
- D. Mason County Fill and Grade Permit

***** END OF SECTION *****

SECTION 01200

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 SCOPE

This Section further defines Measurement and Payment for this project.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
GC Section 3.04.12	Measurement and Payment
01290	Schedule of Values
01300	Submittals

1.3 MEASUREMENT

Measurement for all items shall be as indicated in these Specifications for unit price and lump sum price bid items. Bid items are outlined in detail in this Specification Section and listed in the Proposal.

Measurement shall be in accordance with Section 1-09.1 of the WSDOT Standard Specifications. Volumes of gravel materials and concrete volumes shall be measured by the Engineer in the field and quantities will be limited to the relative neat line dimensions shown on the Plans or as approved by the Engineer in the field.

Weighing equipment, scale verification checks, load tickets for quarry spalls, rock riprap, cobbles, gravel materials, hot mix asphalt, bituminous construction materials, etc., shall conform to Section 1-09.2 of the WSDOT Standard Specifications. Load tickets shall include all gravel materials, cast-in-place concrete, cement grout, CDF, hot mix asphalt, ATB, and reinforcing steel. The Owner will pay for no material received by weight unless they have been weighed as required in this Section or as required by another method the Engineer has approved in writing. All costs incidental to weighing shall be merged into the various unit prices bid.

1.4 INDIVIDUAL BID ITEMS

The following is a list of bid items for the project. The contract price for each item constitutes full compensation for furnishing all equipment, labor, materials, appurtenances, and incidentals and performing all operations necessary to construct and complete the various bid items in accordance with the Contract

Documents. Payment for each item shall be considered as full compensation, notwithstanding that minor features may not be mentioned herein. Work paid for under one item will not be paid for under any other item. If a particular item of work shown on the Plans or described in Specifications is not described in a specific bid item, this item of work shall be considered as incidental to the work and the costs for this work shall be merged into the various respective unit price and lump sum bid items.

A. BASE BID

1. Mobilization and Demobilization

- a. Measurement: Will be measured by lump sum.
- b. Payment: The lump sum contract price for MOBILIZATION AND DEMOBILIZATION shall include all costs for the labor, materials, and equipment required for mobilization and demobilization on the project as described in Section 01505.

Payment for MOBILIZATION AND DEMOBILIZATION shall be as follows:

35% Payment: When Contractor has mobilized on-site and temporary facilities are in place.

50% Payment: When 5 percent of the total pay items are completed (not including payment for materials on hand).

75% Payment: When 50 percent of the total pay items are completed (not including payment for materials on hand).

100% Payment: When Project is completed and recommended for acceptance.

This item shall also include costs for all labor, material, and equipment to provide temporary traffic control for the project as specified in Section 01950.

2. Minor Change

- a. Measurement: Will be negotiated prior to commencing any such work under this pay item and shall be for work to

remedy unforeseen conditions, utility conflicts, minor landscaping, minor drainage improvements, or special surface restoration.

- b. Payment: Payment or credits for changes amounting to \$15,000 or less may be made under the Bid Item MINOR CHANGE. At the discretion of the Owner, this procedure for Minor Changes may be used in lieu of the more formal procedure as outlined in General Conditions Section 3.04.6. The Contractor will be provided a copy of the completed order for Minor Changes. The agreement for the Minor Changes will be documented by signature of the Contractor or notation of the verbal agreement. If the Contractor is in disagreement with anything required by the order for Minor Changes, the Contractor may protest the order as provided in General Conditions Section 3.04.8.

Payments or credits will be determined in accordance with General Conditions Section 3.04.6. All Minor Change work will be within the scope of the Contract Work and will not change Contract Time. For the purpose of providing a common Proposal for all Bidders, the Owner has entered an amount for MINOR CHANGE in the Proposal to become part of the total Bid by the Contractor.

3. Trench Excavation Safety Systems

- a. Measurement: Will be measured by lump sum.
- b. Payment: The lump sum contract price for TRENCH EXCAVATION SAFETY SYSTEMS shall include all costs for labor, materials, and equipment required to provide sheeting, shoring, and bracing of trenches and open excavations as required to meet the Washington Industrial Safety and Health Act, Chapter 49.17 RCW and Section 02250. These costs shall not be considered incidental to any other bid item.

4. Clearing and Grubbing

- a. Measurement: Shall be measured by lump sum.
- b. Payment: The unit price per lump sum for CLEARING AND GRUBBING which shall include all costs for the labor, materials, and equipment to clear and grub the

project site as shown on the Plans and as specified in Section 02230, as well as fees and permits related to disposal.

5. Locate Existing Utilities

- a. Measurement: Will be measured by lump sum.
- b. Payment: The lump sum contract price for LOCATE EXISTING UTILITIES shall include all costs for labor, materials, and equipment required to pothole and locate existing utilities as shown on the Plans and as specified in Section 02050.

6. Project Temporary Traffic Control

- a. Measurement: Will be measured by lump sum.
- b. Payment: The lump sum contract price for PROJECT TEMPORARY TRAFFIC CONTROL shall include all costs for labor, materials, and equipment required to provide traffic control as shown on the Plans and as specified in Section 01950.

7. Erosion Control

- a. Measurement: Shall be measured by lump sum.
- b. Payment: The lump sum contract price for EROSION CONTROL shall include all costs for the labor, material, and equipment for installation and maintenance of all temporary erosion and sediment control measures and best management practices (BMPs), as shown on the Plans and as further described in Section 02370.

8. Unsuitable Excavation

- a. Measurement: Will be measured by the cubic yard, in-place and shall be to the limits as designated by the Engineer. There shall be no payment if the Engineer believes removal of materials is needed because of damage caused by the Contractor's operations.

All quantities will be measured and recorded by the Engineer in his Daily Report and the Contractor shall be

responsible for reconciling his quantities with the Engineer on a daily basis.

- b. Payment: The unit price per cubic yard for UNSUITABLE EXCAVATION shall include all cost for labor, material, and equipment to excavate and wastehaul unsuitable native subgrade materials.

The Contractor is advised that the excavation of any and all unsuitable material must be authorized by the Engineer in writing prior to the commencement of said excavation by the Contractor.

9. Sitework

- a. Measurement: Shall be measured by lump sum.
- b. Payment: The lump sum contract price for SITEWORK shall include all costs for labor, materials, and equipment to clear and grub, prepare and protect trees for off-site disposal, excavate, dewater, wastehaul excess native material to an approved disposal site, and grade and compact site as shown on the Plans and as specified herein. This shall also include all costs for labor, materials, and equipment to provide complete installation of fencing and gates including but not limited to new concrete footings, posts, bars, tension wire, barbed wire, chain link fabric, and all hardware.

10. Foundation Gravel

- a. Measurement: Shall be measured per ton, in place, based on truck tickets, and shall be to the limits shown on the Plans or as required by encountered subgrade conditions as approved by the Engineer.
- b. Payment: The unit price bid per cubic yard for FOUNDATION GRAVEL shall include all costs for the labor, material, and equipment for furnishing and installing foundation gravel in trenches and below structures as shown on the Plans and as described Section 02700. The quantity of material for payment shall be based volume of material placed within the neat line limits as shown on the Plans and as approved by the Engineer.

In the event the Contractor overexcavates the trench depth, or if the trench width becomes wider than the pay limit shown on the Plans, all material so placed shall be at the Contractor's sole expense.

11. Bank Run Gravel

- a. Measurement: Shall be measured per ton, in-place, based on truck tickets and shall be to the limits designated and approved by the Engineer.
- b. Payment: The unit price bid per ton for BANK RUN GRAVEL shall include all costs for the labor, material, and equipment associated with furnishing, installing, and testing bank run gravel and wastehauling native material as shown on the Plans and as described in Sections 02300 and 02700. Payment shall be based on the weight of material installed, as approved by the Engineer.

12. Crushed Surfacing Top Course

- a. Measurement: Shall be measured per ton, in-place, based on truck tickets and shall be to the limits designated and approved by the Engineer.
- b. Payment: The unit price bid per ton for CRUSHED SURFACING TOP COURSE shall include all costs for the labor, material, and equipment associated with furnishing, installing, and testing crushed surfacing top course as shown on the Plans and as described in Section 02710. Payment shall be based on the weight of material installed, as approved by the Engineer.

13. Crushed Surfacing Base Course

- a. Measurement: Shall be measured per ton, in-place, based on truck tickets and shall be to the limits designated and approved by the Engineer.
- b. Payment: The unit price bid per ton for CRUSHED SURFACING BASE COURSE shall include all costs for the labor, material, and equipment associated with furnishing, installing, and testing crushed surfacing top course as shown on the Plans and as described in

Section 02710. Payment shall be based on the weight of material installed, as approved by the Engineer.

14. Site Restoration

- a. Measurement: Shall be measured by lump sum.
- b. Payment: The lump sum contract price for SITE RESTORATION shall include all costs for the labor, material, and equipment associated with cleanup, surface restoration, topsoil, and hydroseeding as shown on Plans and as specified in Section 02900.

15. Piping, Valves, and Appurtenances

- a. Measurement: Shall be measured by lump sum.
- b. Payment: The lump sum contract price for PIPING, VALVES, AND APPURTENANCES, shall include all costs for the labor, materials, and equipment to install piping, valves, and appurtenances including, but not limited to trench excavation, dewatering, bedding, backfilling with bank run gravel or suitable native material, compaction, connecting to existing system, pipe penetrations, water piping, storm piping, fittings, valves, fire hydrants and bollards, Type 2 catch basins, vaults, gravel ballast, pipe supports, thrust blocks, CDF between catch basins and reservoir ring wall, locating tape, copper wire, flexible expansion couplings, disinfection and testing as shown on the Plans and as specified herein.

16. Connection to Existing System

- a. Measurement: Shall be measured per each.
- b. Payment: The unit price per each for CONNECTION TO EXISTING SYSTEM shall include all costs for labor, materials and equipment to furnish and install the connection to the existing system as shown on the Plans and as specified in Section 02500 of the Specifications. The unit price shall also include all costs for excavation, dewatering, backfill with native material, compaction, disinfection and testing to provide a watertight finish, removal of existing pipe and fittings, installation of required caps, plugs, temporary blow offs and other

miscellaneous fittings as required to connect the existing system and disconnect from the abandoned system.

17. 87,000-Gallon Concrete Reservoir and Foundation
 - a. Measurement: Shall be measured per lump sum.
 - b. Payment: The unit price per lump sum for the 87,000-GALLON CONCRETE RESERVOIR AND FOUNDATION shall constitute full compensation for furnishing, installing, manufacturing, and erecting the 87,000-GALLON CONCRETE RESERVOIR AND FOUNDATION, foundation, overflow piping, inlet, outlet, drain piping, and appurtenances (under and within the 87,000-GALLON CONCRETE RESERVOIR AND FOUNDATION), all accessories, appurtenances, dewatering, and testing. The reservoir foundation shall include all concrete and reinforcing steel necessary for a complete installation in good working order, as shown on the Plans and as specified herein.
18. Booster Station Building
 - a. Measurement: Shall be measured by lump sum.
 - b. Payment: The lump sum contract price for BOOSTER STATION BUILDING shall include all costs for labor, materials, and equipment to construct the booster station building including, but not limited to, concrete, foundation, wooden structure, beams, wood trusses, roofing, trim siding, doors, insulation, hardware, painting and HVAC as shown on the Plans and as Specified herein. This item shall also include all internal piping inside the building up to the prepackaged pump skid.
19. Packaged Booster Station
 - a. Measurement: Shall be measured by lump sum.
 - b. Payment: The lump sum contract price for PACKAGED BOOSTER STATION shall include all costs for the labor, material, and equipment to furnish, install, test, and commission the packaged booster station as shown on the Plans and as specified in Section 11265.

20. Telephone Service

- a. Measurement: Shall be measured by lump sum.
- b. Payment: The lump sum contract price shall include all costs associated with the modifications to the telephone service provided by Hood Canal Communications. For bidding purposes, an amount of \$5,000 will be included in the proposal for TELEPHONE SERVICE line item. The Owner will pay the actual invoice cost of service modifications completed by Hood Canal Communications. All other costs or coordinating the telephone service modifications shall be included in the bid item for ELECTRICAL, TELEMETRY, AND INSTRUMENTATION.

21. Electrical, Telemetry, and Instrumentation

- a. Measurement: Shall be measured by lump sum.
- b. Payment: The lump sum price for ELECTRICAL, TELEMETRY, AND INSTRUMENTATION shall include all costs for labor, materials, tools, and equipment to furnish and install electrical, telemetry, and instrumentation components of this Project, including conduit, wiring, grounding, and all other work as shown on the Plans and as described in Divisions 13 and 16 of these Specifications.

B. ADDITIVE A

1. Fence and Gates

- a. Measurement: Shall be measured by lump sum.
- b. Payment: The lump sum contract price for INTERTIE, shall include all costs for the labor, materials, and equipment to install piping, valves, and appurtenances in order to establish a new intertie between the Union Ridge and Vuecrest systems including, but not limited to trench excavation, dewatering, bedding, backfilling with bank run gravel or suitable native material, compaction, connecting to existing system, water piping, fittings, valves, thrust blocks, locating tape, copper wire, disinfection and testing as shown on the Plans and as specified herein.

2. Intertie

- a. Measurement: Shall be measured by lump sum.
- b. Payment: The lump sum contract price for INTERTIE, shall include all costs for the labor, materials, and equipment to install piping, valves, and appurtenances in order to establish a new intertie between the Union Ridge and Vuecrest systems including, but not limited to trench excavation, dewatering, bedding, backfilling with bank run gravel or suitable native material, compaction, connecting to existing system, water piping, fittings, valves, thrust blocks, locating tape, copper wire, disinfection and testing as shown on the Plans and as specified herein.

3. Demolition

- a. Measurement: Will be measured by lump sum.
- b. Payment: The lump sum contract price for DEMOLITION shall include all costs for labor, materials, and equipment associated with demolition of the existing concrete tank, disconnection and salvage of the existing tank appurtenances and booster station components to the Owner, wastehaul of any non-salvaged material, and demolition of piping, and appurtenances as shown on the Plans and as specified in Section 01900.

1.5 PROJECT MATERIALS ON HAND

See General Conditions Section 3.04.12(6).

1.6 PAYMENT

Payment for all work will be made at the contract unit price or lump sum price as indicated in the Proposal, payment of which shall constitute full compensation, for a complete installation.

For items of equipment, acceptable operating and maintenance information shall be delivered to the Engineer before the Contractor will be paid for more than 90 percent of the purchase value of that equipment. Purchase value shall be the net price for the equipment as given on the invoice.

Final operating and maintenance manuals per Section 01300 must be delivered to the Engineer prior to the Project being 90 percent complete. Progress payments for work in excess of 90 percent completion will not be made until the specified acceptable operating and maintenance information has been delivered to the Engineer.

***** END OF SECTION *****

SECTION 01290

SCHEDULE OF VALUES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section establishes the procedures for preparing the schedule of values used for preparation of the Contractor's progress pay estimates.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
GC Section 3.04.12	Measurement and Payment
01200	Measurement and Payment
01300	Submittals

1.3 DESCRIPTION

Within 14 calendar days following receipt of Notice to Proceed, the Contractor shall submit to the Engineer, for review and approval, a complete breakdown of components of all lump sum bid items showing the value assigned to each portion of the work. The schedule of values shall be prepared in such form, and supported by data that substantiates its accuracy as may be required by the Engineer. This schedule of values shall, once approved by Engineer, be used as the basis for reviewing and determining each monthly progress payment estimate and as such shall be subject to periodic review by the Engineer to assure that the schedule of values reasonably represents, in the opinion of the Engineer, the actual value of the individual items of work to be performed. No payments shall be made until the schedule of values has been approved.

***** END OF SECTION *****

SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes requirements that apply to all equipment and materials supplied on the Project.

The Contractor shall be responsible for the accuracy and completeness of the information contained in each submittal and shall assure that the material, equipment or method of work shall be as described in the submittal. The Contractor shall verify that all features of all products conform to the requirements of the Contract Documents. Submittal documents shall be clearly edited to indicate only those items, models, or series of equipment that are being submitted for review. All extraneous materials shall be crossed out or otherwise obliterated. The Contractor shall ensure that there is no conflict with other submittals and notify the Engineer in each case where their submittal may affect the work of another contractor or the Owner. The Contractor shall ensure coordination of submittals among the related crafts and subcontractors and shall verify such coordination on all submittals.

Where noted in the Contract Documents, the structural, mechanical, and electrical designs associated with the indicated equipment items are specific to the manufacturer and model number specified. Any structural, mechanical, or electrical modifications required to utilize an approved substitution to the specified equipment shall be made by the Contractor at no additional cost to the Owner. Where approved substitutions of specified equipment affect other materials or equipment, mechanical, structural, or electrical work, the Contractor shall note in the equipment submittal any necessary changes to accommodate the substituted equipment. It shall also be the responsibility of the Contractor to coordinate other mechanical, structural, or electrical equipment submittals to make sure that all changes necessary to accommodate the substituted equipment are addressed in these submittals as well. See General Condition 3.04.3.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01720	Record Drawings
01800	Testing, Commissioning, and Training
11000	Equipment General Provisions
Division 16	Electrical

1.3 WORK INCLUDED

Submittals required for this work shall include any or all of the following as required by the particular specification section and the submittal schedule:

- A. Schedules and Plans
- B. **PRODUCT SUBMITTALS**
 - 1. Manufacturer's Literature
 - 2. Shop Drawings
 - 3. Color and Material Samples
 - 4. Design Calculations
 - 5. Test Reports
- C. Equipment Operation and Maintenance Manuals
- D. Record Drawings

1.4 SUBMITTAL INFORMATION

Shop, catalog, and other appropriate drawings and information shall be submitted to the Engineer for review prior to fabrication or ordering of all equipment and materials specified. The number of copies of submittal information to be submitted shall be as indicated below.

All submittal information shall be sent to the Engineer through the Contractor. The Contractor shall assign a separate submittal number to each item or group of items that relate to each specification section. Submittal numbers shall be assigned in consecutive ascending order, with the first project submittal assigned the number "1." Resubmittals shall be numbered using the same number followed by an alphabetical suffix. All submittals shall bear the Contractor's certification that they have reviewed, checked, and approved the submittal information prior to transmitting to the Engineer. The submittal number and related specification section shall be marked on each submittal.

PART 2 PRODUCTS

2.1 GENERAL

When the Contract Documents require a submittal the contractor shall submit one copy of submittals electronically for all submittals except Equipment Manuals. Two hard copies of Equipment Manuals must be submitted. If submittals are provided electronically, only one reviewed copy will be returned to the Contractor.

Electronic submittals shall be provided in tabbable, searchable, pdf format and should include a table of contents bookmarked to provide a navigation link to each section of the submittal. Information should be clear and legible. Information pertaining to the specific materials proposed for use on the project shall be highlighted.

2.2 PRODUCT SUBMITTALS

A. GENERAL

When indicated in the Contract Documents the contractor shall submit product data for review by the Engineer. Unless otherwise specified, within 10 calendar days after receipt of the submittal, the Engineer shall review the submittal and return three copies of the marked-up submittal. The reproducible original will be retained by the Engineer. The returned submittal shall indicate one of the following actions:

1. If the review indicates that the material, equipment, or work method complies with the project Specifications, submittal copies will be marked “NO EXCEPTIONS TAKEN.” In this event, the Contractor may begin to implement the work method or incorporate the material or equipment covered by the submittal.
2. If the review indicates limited corrections are required, copies will be marked “MAKE CORRECTIONS NOTED.” The Contractor may begin implementing the work method or incorporating the material and equipment covered by the submittal in accordance with the noted corrections. Where submittal information will be incorporated in operation and maintenance data, a corrected copy shall be provided.
3. If the review reveals that the submittal is insufficient or contains incorrect data, copies will be marked “AMEND AND RESUBMIT.” Except at their own risk, the Contractor shall not undertake work covered by this submittal until it has been revised, resubmitted, and returned marked either “NO EXCEPTIONS TAKEN” or “MAKE CORRECTIONS NOTED.”
4. If the review indicates that the material, equipment, or work method does not comply with the project Specifications, copies of the submittal will be marked “REJECTED - SEE REMARKS.” Submittals with deviations that have not been identified clearly may be rejected. Except at their own risk, the Contractor shall not undertake the work covered by such submittals until a new

submittal is made and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED."

B. MANUFACTURER'S LITERATURE

Where the contents of submitted literature include data not pertinent to the submittal, the portion(s) of the contents being submitted for the Engineer's review shall be clearly indicated.

C. SHOP DRAWINGS

Shop drawings shall be submitted in the form of blue-line or black-line prints of each sheet. Blueprint submittals will not be acceptable.

All shop drawings shall be accurately drawn to a scale sufficiently large enough to show pertinent features and method of connection or joining. On all shop drawings, figure dimensions shall be used as opposed to scaled dimensions.

D. COLOR AND MATERIAL SAMPLES

All material samples shall be of the exact article proposed to be furnished for the work and shall be submitted in the quantity required. Samples shall be returned to the Contractor, with one retained by the Engineer.

Unless the precise color is specifically described in the Contract Documents, or whenever a choice of color or pattern is available in a specified product, accurate color charts shall be submitted to the Engineer for their review and selection.

E. DESIGN CALCULATIONS

Where required in the Specifications, design calculations shall be submitted to the Engineer. Design calculations shall be complete, concise, and in an easy-to-read format. All design calculations shall be stamped by a Professional Engineer licensed in the State of Washington.

F. TEST REPORTS

Copies of all test reports shall be submitted to the Engineer.

2.3 EQUIPMENT MANUALS

A. GENERAL

For all items of equipment, manufacturer's equipment operation and maintenance manuals shall be submitted to the Engineer for review. One copy will be returned to the Contractor with comments.

The following information shall be furnished for all items of equipment installed on the project requiring operational and/or maintenance procedures, and for any additional items indicated by the Engineer.

1. Lubrication Information

This shall consist of the manufacturer's recommendations regarding the lubricants to be used and the lubrication schedule to be followed.

2. Electrical and Control Diagrams

Diagrams shall show internal and connection wiring.

3. Startup Procedures

These instructions consist of equipment manufacturer's recommendations for installation, adjustment, calibration, and troubleshooting.

4. Operating Procedures

These instructions consist of the equipment manufacturer's recommended step-by-step procedures for starting, operating, and stopping the equipment under specified modes of operation.

5. Preventive Maintenance Procedures

These instructions consist of the equipment manufacturer's recommended steps and schedules for maintaining the equipment.

6. Overhaul Instructions

These instructions consist of the manufacturer's directions for the disassembly, repair, and reassembly of the equipment and any safety precautions that must be observed while performing the work.

7. Parts List

This list consists of the generic title and identification number of each component part of the equipment.

8. Spare Parts List

This list consists of the manufacturer's recommendations of number of parts, which should be stored by the Owner and any special storage precautions, which may be required.

9. Exploded View

Exploded or cut views of equipment shall be provided if available as a standard item of the manufacturer's information. When exploded or cut views are not available, plan and section views shall be provided with detailed callouts.

10. Test Documentation

Reports, records, data and forms documenting the results of equipment factory tests, including pump and blower performance curves, shall be provided, with the operating points for the specific equipment designated. When a special factory test of the supplied equipment is not performed, the manufacturer's standard performance reports and curves, with specified operating points, shall be provided for the supplied equipment.

11. Specific Information

Where items of information not included in the above list are required, they will be provided as described in the specifications for the equipment.

12. Warranty Information

13. Maintenance Information Summaries

In addition, the following items of equipment shall be provided with Maintenance Information Summaries in each appropriate section of the equipment manuals, prepared according to the format specified herein:

- Heating and Ventilation Equipment

- Valves (larger than 1-inch in size)
- Pumps
- Pressure Tanks
- Plant Instrumentation, Telemetry and Control Equipment
- Electrical Equipment

Maintenance information summaries shall be prepared on 8-1/2-inch x 11-inch paper only and shall contain the following information compiled from manufacturer's recommendations in the order shown.

1. Description or name of item of equipment.
2. Manufacturer.
3. Name, address, and telephone number of local manufacturer's representative.
4. Serial number (where applicable). The Contractor shall verify that it matches the equipment installed on the project.
5. Equipment nameplate data including model number.
6. Recommended maintenance procedures:
 - a. Description of procedures.
 - b. Maintenance frequency required.
 - c. Lubricant(s) or other materials required (where applicable), including type of lubricant, lubricant manufacturer, and specific compound.
 - d. Additional information as required for proper maintenance.
7. Recommended spare parts.

The maintenance information summary shall be placed at the beginning of the manual.

All operation and maintenance information shall be comprehensive and detailed, and shall contain information adequately covering all normal operation and maintenance procedures.

For ease of identification, each manufacturer's brochure and manual shall be appropriately labeled with the equipment name and equipment specification number as it appears in the project Specifications. The information shall be organized in binders. The binders shall be provided with a table of contents and tab sheets to permit easy location of desired information.

Lubricants shall be described in detail, including type, recommended manufacturer, and manufacturer's specific compound to be used.

It shall be the responsibility of the Contractor to ensure that all operation and maintenance materials are obtained. Material submitted must meet the approval of the Engineer prior to project acceptance.

B. EXTRANEOUS DATA

Where the contents of the manuals include manufacturers' standard brochures or catalog pages, the exact item(s) used in this installation shall be clearly indicated and all manufacturers' data which is extraneous shall be clearly deleted.

C. FINAL EQUIPMENT MANUALS

The Contractor shall be responsible for tracking and coordinating each separate manufacturer's equipment operation and maintenance manual submittal and shall resubmit, as necessary, until the Engineer's review indicates that the submittal is acceptable. The Contractor shall maintain equipment manual files until final approval copies are delivered to the Engineer. The Contractor shall be responsible for collating the approved operation and maintenance submittal sections into complete final manufacturers' equipment operation and maintenance manuals bound in post binders which are indexed to the Specifications. The Contractor shall deliver the complete final operation and maintenance manuals to the Engineer prior to project completion. All copies final manufacturers' equipment manuals submitted will be retained by the Engineer or Owner.

The Contractor shall also supply three CD-Rom or USB copies of the final equipment manuals in a tabbed, searchable, .pdf format, with a table of contents bookmarked to provide a navigation link to each section of the manual.

PART 3 EXECUTION

3.1 IDENTIFICATION OF SUBMITTALS

A. GENERAL

Each submittal shall be accompanied by a letter of transmittal showing the date of transmittal, specification section, or drawing number to which the submittal pertains, submittal number, and a brief description of the material submitted.

B. RESUBMITTALS

When material is resubmitted for any reason, it shall be submitted under a new letter of transmittal and referenced to the previous submittal.

3.2 REVIEW OF SUBMITTALS

The Engineer will review all submittals for general conformance with the design and other requirements of the Contract Documents. Markings or comments shall not be construed as relieving the Contractor from compliance with the Contract Documents. Submittals may be rejected based on inadequate information and/or not meeting the requirements of the Contract Documents. Rejection of submittals requires action on the part of the Contractor to correct the reason for the rejection. The Contractor remains responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, and for techniques of assembly and installation.

3.3 COORDINATION OF PRODUCT SUBMITTALS

A. GENERAL

Prior to submittal for review by the Engineer, all data shall be fully coordinated, including the following:

1. All field dimensions and conditions.
2. All trades and public agencies involved, including necessary approvals.
3. All deviations from the Contract Documents.

B. GROUPING OF SUBMITTALS

1. All submittals shall be grouped with associated items, unless otherwise specifically permitted by the Engineer.
2. The Engineer may reject the submittals in their entirety or any part thereof, if not in accordance with the Contract Documents.

C. CERTIFICATION

Submittals shall bear the Contractor's certification that they have reviewed, checked, and approved the shop drawings prior to forwarding them to the Engineer.

3.4 TIMING OF PRODUCT SUBMITTALS

A. GENERAL

1. All submittals shall be made far enough in advance of installation to provide all required time for reviews and securing necessary approvals.
2. In scheduling, the Contractor shall allow for the time indicated in Part 2.2A for the Engineer's review following their receipt of the submittal.

B. DELAYS

No additional or separate payment will be made for costs of delays occasioned by tardiness of submittals on the part of the Contractor.

3.5 EQUIPMENT MANUALS

The preliminary copies of the manufacturer's equipment manuals shall be delivered to the Engineer for review not later than the time of equipment delivery to the project site.

Final copies of the manufacturer's equipment manuals shall be delivered to the Engineer at least 14 calendar days prior to requesting payment in excess of 90 percent completion for the project. Prior to submittal of the final equipment manuals, the Contractor shall check the manuals for accuracy and completeness and shall verify that prior review comments have been addressed.

***** END OF SECTION *****

SECTION 01310

PROJECT MEETINGS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes information pertaining to the various meetings that will be held during the course of constructing this project.

1.2 PRECONSTRUCTION CONFERENCE

As soon as possible following the award of the Contract, a preconstruction conference shall be scheduled for representatives of the Owner, the Contractor, the Engineer, funding agencies, regulatory agencies, and affected utilities.

1.3 PROJECT PROGRESS MEETINGS

The Owner and the Engineer will schedule and attend regular weekly meetings with the Contractor for coordination, administrative, and procedural requirements of the project. The Contractor shall provide a meeting room with table and chairs at or near the site for project progress meetings. At the discretion of the Owner, project meetings may be held virtually.

1.4 CONSTRUCTION MEETINGS

The Contractor shall schedule and hold regular meetings during the project:

- A. Safety Meetings (Contractor's subcontractors shall attend if they are working onsite.)
- B. Project Progress Meetings
- C. Equipment Installation Meetings
- D. Coordination Meetings
- E. Startup and Testing Meetings

The Contractor shall notify the Owner and Engineer in advance of all meetings. The meetings may or may not be attended by the Owner and Engineer.

***** END OF SECTION *****

SECTION 01400

QUALITY CONTROL

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the control tests, test sample collection, required field-testing, and special inspections as specified herein, and indicated on the Plans.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
02300	Earthwork
02700	Gravel Materials
02710	Gravel Surfacing
03300	Reinforced Concrete

1.3 PAYMENT

All testing as required by this Section shall be paid for by the Contractor. All costs to prepare and implement the sample and testing program shall be included in the bid prices for the various items associated with the sampling and testing program.

Retesting and reinspection required because of defective work and testing performed for the convenience of the Contractor shall also be paid for by the Contractor.

Testing requirements shall not be cause for claims of delay by the Contractor and all expenses accruing therefrom shall be deemed incidental to the performance of the Contract.

PART 2 PRODUCTS

2.1 GENERAL

The Contractor shall be responsible for all material testing specified in the Contract Documents and any applicable permits and codes. The materials testing laboratory shall be accredited for performing the various testing methods either by AASHTO R18, AASHTO 150/IEC 17025 or the American Association for Laboratory Accreditation and further approved by the Owner. The materials testing laboratory shall send test results directly to the Engineer.

2.2 EARTHWORK AND GRANULAR MATERIALS

A. COMPACTION CONTROL

Optimum moisture content and maximum density tests shall be determined by the following method:

ASTM D1557 – Laboratory Compaction Characteristics of Soil Using Modified Effort

B. IN-PLACE TESTS

In-place density and moisture content tests shall be made by an independent testing laboratory according to the following methods:

ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

2.3 AGGREGATES

All aggregates shall be tested in accordance with applicable WSDOT test methods:

<u>Title</u>	<u>Test Method</u>
Sampling	AASHTO T2
Sieve Analysis of Fine and Coarse Aggregates	104A
Material Finer than No. 200 Sieve in Aggregates	102A
Percentage of Particles Smaller than 0.025 mm and 0.005 mm	603A
Organic Impurities	111A
Abrasion of Coarse Aggregates by Use of the Los Angeles Machine	101A
Sand Equivalent	109A

2.4 CAST-IN-PLACE CONCRETE

Cast-in-place concrete shall be tested in accordance with applicable parts of Chapter 16 of ACI 301. Concrete reinforcement and concrete special inspections shall be performed in accordance with local Building Official and WABO requirements.

PART 3 EXECUTION

3.1 SAMPLING AND TESTING FREQUENCY

A. GENERAL

The Contractor shall provide the following quality control tests at the number and frequency described herein. On-site testing technicians and testing laboratories shall be WABO-certified. The precise location of the tests shall be designated by the Engineer. The Contractor shall cooperate with laboratory personnel employed to conduct the density testing, sampling of material(s), and special inspections. The Contractor shall provide safe access within the work site for laboratory personnel such that density testing and visual inspection can be performed. The Contractor shall provide samples of materials to be tested in the quantities required and herein specified to the appropriate laboratory personnel. The Contractor shall furnish all labor, equipment, tools, and materials necessary to obtain and deliver samples as herein designated. They shall also provide and repair any test holes required in order to facilitate the testing and sampling and to provide for the testing laboratory's exclusive use for storage and curing of test samples until removed to the laboratory.

Any areas tested and further failing compliance with the Specifications shall be recompacted and retested at the Contractor's expense, until a successful density test indicating compliance with these Specifications has been achieved.

B. SOIL TESTING

The following soil quality control tests shall be completed at the given frequency:

<u>Material</u>	<u>Test</u>	<u>Minimum Sampling & Testing Frequency</u>
Backfill for foundations, walls, trenches and roads	Gradation ¹	One every 500 cy or one per day for quantities exceeding 25 cy. For trenches, one every 750 feet of trench.

<u>Material</u>	<u>Test</u>	<u>Minimum Sampling & Testing Frequency</u>
	In-Place Density ^{2,3,4}	One every 500 cy or one per day for each type of soil or fill material with quantities exceeding 25 cy. For trenches, one per day and one every 250 feet of trench.
	Moisture-Density Relationship ³	One prior to start of backfilling operation, one every 20 densities and any time material type changes.
Pipe Bedding	Gradation ¹	One every 750 feet of trench.
Subgrade and Fills	In-Place Density ^{2,3}	One every 500 cy of each type material.
	Moisture-Density Relationship	One for every 20 densities for each material.
	Gradation	One for every moisture-density.

1. All acceptance tests shall be conducted from in-place samples.
2. Additional tests shall be conducted when variations occur due to the Contractors, operations, weather conditions, site conditions, etc.
3. The nuclear densometer, if properly calibrated, may be used but only to supplement the required testing frequency and procedures. The densometer shall be calibrated and is recommended for use when the time for complete results becomes critical.
4. Depending on soil conditions, it is anticipated that compaction tests shall be required at depths of 2 feet above the pipe and at each additional 5 feet to the existing surface plus a test at the surface.

C. CONCRETE TESTING

All testing shall conform to applicable portions of ACI. Special inspections of concrete and concrete reinforcement shall comply with WABO requirements.

All concrete must meet the specified requirements for minimum 28-day compressive strength.

All concrete cylinders shall be molded and tested for strength by an independent testing laboratory employed by the Contractor.

The Contractor shall furnish all concrete required for molding of the cylinders. In cases where cylinders are stored at the project site, the Contractor shall provide storage and protection for the cylinders in accordance with ACI requirements.

Concrete tests and testing frequency shall be in accordance with the more stringent of the testing requirements specified in Section 03300-3.17 of these Specifications, and the following table:

<u>Material</u>	<u>Test</u>	<u>Minimum Sampling & Testing Frequency</u>
Coarse Aggregate (for each grading size) ¹	Gradation	One test every 500 cy of concrete.
	Deleterious Substances	One test initially and thereafter when appearance makes the material suspect.
	L.A. Abrasion	One every 2,000 tons of aggregate.
	Moisture specific gravity and absorption ¹	One initially and every 250 cy thereafter. One moisture to be conducted prior to any batching and more frequently if hauling and storage does not provide a consistent moisture content.
Fine Aggregate ¹	Gradation and fineness modules	One every 250 cy of concrete.
	Deleterious Substances	(same as coarse aggregate).
	Moisture, specific gravity and absorption ¹	(same as coarse aggregate).
Concrete	Slump	Conduct one test every day of placement and one additional test for every 50 cy placed and more frequently if batching appears inconsistent. Conduct in conjunction with taking concrete cylinders.
	Entrained Air	Conduct with each slump test.
	Ambient and concrete temperatures	Conduct with each slump test.

<u>Material</u>	<u>Test</u>	<u>Minimum Sampling & Testing Frequency</u>
Concrete	Compressive strength and evaluation of results per ACI 214. (includes unit weight of each cylinder)	For all concrete placement, take one set of four cylinders per day and one additional set of cylinders for every 50 cy of each class of structural concrete. Cylinders shall be 4 inch by 8 inch. Test one cylinder at 7 days and two at 28 days. Fourth cylinder shall be held in reserve. A plot and statistical evaluation shall be maintained in accordance with ACI 214 for compressive strength results. Field cure cylinders shall be made when insitu strengths are required to be known.

1. Aggregate moisture tests are to be conducted in conjunction with concrete strength tests for water/cement (w/c) calculations.

D. SPECIAL INSPECTIONS

Contractor shall perform all required Special Inspections per WABO requirements (Chapter 17 of the IBC). Special inspections include, but are not limited to, concrete soils and wood.

***** END OF SECTION *****

SECTION 01500

TEMPORARY FACILITIES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the temporary facilities required for this project, but not necessarily limited to:

- A. Temporary utilities such as water, electricity, telephone, off-site staging, and off-site parking.
- B. Temporary piping, pumps, valves, fittings, manholes, vaults, and appurtenances necessary to keep existing facilities fully operational during construction.
- C. Sanitary facilities.
- D. Temporary enclosures such as fences, tarpaulins, barricades, and canopies.

PART 2 PRODUCTS

2.1 UTILITIES

A. TEMPORARY ELECTRICITY

The Contractor shall provide temporary power for construction at the project site. They shall make arrangements with the electrical utility (to obtain temporary power) and shall pay all costs and fees charged by the utility associated with connection of temporary power. The Contractor shall provide all special connections, receptacles, panelboards, etc., which are required for temporary service, and are not provided by the utility.

The Contractor shall furnish and install all temporary wiring and associated equipment required to keep all portions of the existing facilities in operation at all times.

Area distribution boxes shall be furnished, installed, and so located that the individual trades may use their own construction-type extension cords to obtain proper power and artificial lighting at all points where required. The Contractor shall provide a main disconnect on all temporary wiring panels, labeled "MAIN DISCONNECT," to ensure the safety of personnel using extension cords and hand tools. Panels shall also be properly

grounded and equipped with GFCI breakers in accordance with WISHA requirements.

The Contractor shall provide the Engineer single line diagrams of the temporary wiring showing all circuit breakers. These diagrams shall be provided prior to installation of this wiring. These diagrams are necessary to provide information to Owner personnel for off-hours operation.

The Contractor shall pay all demand, consumption, taxes, and fees associated with the temporary electrical service.

B. WATER

The Contractor shall be responsible for providing water necessary for construction. This includes costs for supplying potable water for hydrostatic pressure leak testing of all water-holding structures and operational testing of all equipment and processes.

2.2 SANITARY FACILITIES

The Contractor shall provide toilet and wash-up facilities for their workforce and the Engineer at the site of work. They shall comply with applicable laws, ordinances, and regulations pertaining to the public health and sanitation of dwellings and camps.

2.3 OFF-SITE STAGING AND PARKING

The Contractor shall note that space is limited throughout the construction site. Employees of the Contractor, all subcontractors, vendors, suppliers, and associated personnel shall not be allowed to park onsite during the course of construction without prior approval from the Owner. It shall be the responsibility of the Contractor to provide sufficient parking facilities in authorized area(s) other than the construction site for the above-mentioned personnel.

The Contractor shall not be allowed to stockpile and store equipment and materials throughout the construction site. The Contractor shall coordinate their schedule so that all equipment and materials shall be brought to the construction site only when they are to be installed/utilized.

The Contractor shall provide storage of equipment and materials at an offsite, bonded warehouse, to be approved by the Engineer. The Contractor shall pay all costs associated with off-site delivery, storage, and transfer to the construction site.

2.4 ENCLOSURES

The Contractor shall furnish, install, and maintain during the project time all required scaffolds, tarpaulins, barricades, canopies, warning signs, steps, bridges, platforms, and other temporary construction necessary for proper completion of the work in compliance with all pertinent safety and other regulations.

PART 3 EXECUTION

All temporary facilities and controls shall be maintained as long as required for the safe and proper completion of the work. The Contractor shall remove such temporary facilities and controls as rapidly as progress of the work will permit or as directed by the Owner.

***** END OF SECTION *****

SECTION 01505

MOBILIZATION AND DEMOBILIZATION

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section consists of mobilization and demobilization. Mobilization consists of preconstruction activities and preparatory work for the project necessary to mobilize labor, materials, and equipment to the project site. Demobilization consists of activities to remove materials and equipment from the project site upon project completion, including final cleanup. Items which are not considered mobilization or demobilization include but are not limited to:

- A. On-going activities throughout the duration of construction.
- B. Profit, interest on borrowed money, overhead, or management costs.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
Division 1	General Technical Requirements

PART 2 PRODUCTS

Products and materials required for mobilization and demobilization are described in the various sections of Division 1 and in other parts of the Contract Documents.

PART 3 EXECUTION

Complete mobilization and demobilization as required by the various sections of Division 1 and other parts of the Contract Documents.

***** END OF SECTION *****

SECTION 01720

RECORD DRAWINGS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the record drawings, which shall be maintained and annotated by the Contractor during construction.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals

1.3 INFORMATION PROVIDED BY THE OWNER

The Contractor will be provided with the following items to maintain record drawings for the project:

- A. One full size paper set of Plans.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall maintain the following record drawings for the project:

- A. A neat and legibly marked set of Contract Plans showing the final location of piping, equipment, electrical conduits, outlet boxes and cables;
- B. Additional documents such as schedules, lists, drawings, and electrical and instrumentation diagrams included in the Contract Documents; and
- C. Contractor layout and installation drawings.

Unless otherwise specified, record drawings shall be full size and maintained in a clean, dry, and legible condition. Record documents shall not be used for construction purposes and shall be available for review by the Engineer during normal working hours at the Contractor's field office. At the completion of the

work, prior to final payment, all record drawings shall be submitted to the Engineer.

Marking of the drawings shall be kept current and shall be done at the time the material and equipment are installed. Annotations to the record documents shall be made with an erasable colored pencil conforming to the following color code:

- A. Additions - Red
- B. Deletions - Green
- C. Comments - Blue
- D. Dimensions - Graphite

Legibly mark drawings to record actual depths, horizontal and vertical location of underground raceways, cables, and appurtenances referenced to permanent surface improvements.

The Contractor's record drawings (full-size hard-copy) will be reviewed monthly for completeness by the Engineer prior to preparing the progress estimate for payment. If the record drawings do not reflect the work performed, payment for that item of work will not be included in the progress estimate.

***** END OF SECTION *****

SECTION 01740

CLEANUP

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the maintenance of the building, structures, and site(s) in a standard of cleanliness throughout the construction period as described herein.

Throughout the construction period, the Contractor shall maintain the cleanliness of the site and structures as described herein. The Contractor is also to maintain access to all existing, operating equipment such that the equipment may be serviced and operated.

Dust of all kinds, including concrete dust produced by construction activities, shall be controlled to avoid damage to existing, operating equipment. Enclosures, ventilation, and air scrubbing may be required where significant potential for damage is determined by the Engineer.

1.2 RELATED WORK SPECIFIED ELSEWHERE

In addition to standards described in this Section, comply with all requirements for cleaning up when described in other sections of these Contract Documents.

1.3 QUALITY ASSURANCE

A. INSPECTION

The Contractor shall conduct daily site inspections, and more often if necessary, to verify that requirements are being met.

B. CODES AND STANDARDS

In addition to the standards described in this Section, comply with all pertinent requirements of governmental agencies having jurisdiction.

PART 2 PRODUCTS

2.1 CLEANING MATERIALS AND EQUIPMENT

Provide all required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.

2.2 COMPATIBILITY

Use only the cleaning materials and equipment which are compatible with the surface being cleaned, as recommended by the manufacturer of the material or as approved by the Engineer.

PART 3 EXECUTION

3.1 PROGRESS CLEANING

A. GENERAL

Retain all stored materials and equipment in an orderly fashion allowing maximum access, not impeding drainage or traffic, and providing protection.

Do not allow the accumulation of scrap, debris, waste material, and other items not required for this work.

At least twice each month, and more often if necessary, completely remove all scrap, debris, and waste material from the project site.

Provide adequate storage for all materials awaiting removal from the project site, observing all requirements for fire protection and protection of the environment.

B. SITE

Daily, and more often if necessary, inspect the site and pick up all scrap, debris, and waste material. Move these items into a place designated for their storage until disposal becomes available.

Weekly, and more often if necessary, inspect all arrangements of materials stored on the site, restack, arrange, or otherwise service all arrangements to meet the requirements above.

Maintain the site in a neat and orderly condition at all times so as to meet the approval of the Engineer.

C. STRUCTURES

Weekly, and more often if necessary, inspect the structures and pick up all scrap, debris and waste material. Move these items into a place designated for their storage until disposal becomes available.

Weekly, and more often if necessary, sweep clean all interior spaces. "Clean" shall be interpreted to mean free from dust and other materials that can be swept with a broom using reasonable diligence.

In preparing to install succeeding materials, clean the structures or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material. Use all equipment and materials required to achieve the required cleanliness.

D. STREETS

All paved and unpaved streets in the vicinity of the project shall be kept free of material tracked from the project site(s) or dropped from vehicles entering and leaving the site(s). The Contractor shall inspect roads in each active area daily, and all material deposited on the road from the Contractor's activities shall be removed prior to the end of the workday. This shall include sweeping, as required, to collect any mud, dirt and dust from the surface. All catch basins and culverts in the work area shall be inspected before completion and cleaned as directed by the Engineer.

3.2 FINAL CLEANING

A. DEFINITION

Except as otherwise specifically provided, "clean" shall be interpreted as meaning the level of cleanliness generally provided by commercial building maintenance equipment and materials.

B. GENERAL

Prior to final inspection, remove from the jobsite all tools, surplus materials, equipment, scrap, debris, and waste. Conduct final project cleaning as described below.

C. STRUCTURES

1. Exterior

Visually inspect all exterior surfaces and remove all traces of soil, waste, smudges, and other foreign matter. Remove all traces of splashed materials from adjacent surfaces. If necessary to achieve a uniform degree of exterior cleanliness, hose down the exterior of the structure. In the event of stubborn stains not removable with

water, the Engineer may require light sandblasting or other cleaning at no additional cost to the Owner.

2. Interior

Visually inspect all interior surfaces and remove all traces of soil, waste, smudges, and other foreign matter. Remove all traces of splashed materials from adjacent surfaces. Remove all paint droppings, spots, stains, and dirt from finished surfaces. Use only appropriate cleaning materials and equipment.

3. Glass

Clean all glass inside and outside.

D. TIMING

Schedule final cleaning as approved by the Engineer to enable the Owner to accept a completely clean project, ready for occupancy.

***** END OF SECTION *****

SECTION 01800

TESTING, COMMISSIONING, AND TRAINING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the installation, testing, commissioning, and training for all mechanical, electrical, and instrumentation systems and completed portions of the work.

See also Section 16050 for additional electrical and instrumentation system testing requirements.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01110	Scope of Work
01300	Submittals
01400	Quality Control
01500	Temporary Facilities
15050	Piping Systems
15400	Plumbing
15700	HVAC
16050	Basic Electrical Materials and Methods

1.3 QUALITY ASSURANCE

A. INSTALLATION

All mechanical, electrical, and instrumentation equipment provided under this Contract shall be installed in conformity with the Contract Documents, including the manufacturer's requirements. Should a manufacturer's installation recommendation conflict with specific requirements of this Contract Document, the Contractor shall bring the matter to the attention of the Engineer. Any additional costs arising out of changes authorized by the Engineer to accommodate manufacturer's installation recommendations will be considered extra work. Any costs incurred by the Contractor through failure to timely notify the Engineer of a difference between Contract Document and manufacturer's installation requirements shall be borne by the Contractor.

B. TESTING

1. General Requirements

All equipment and partially complete or fully completed portions of the work included in this Contract shall be tested and inspected to prove compliance with the Contract requirements. Unless otherwise specified, all costs of testing, including temporary facilities and connections, shall be borne by the Contractor. For the purpose of this Section, equipment shall mean any mechanical, electrical, instrumentation, or other device with one or more moving parts or devices requiring an electrical, pneumatic, or hydraulic connection. Installed leakage tests and other piping tests shall be as specified in Sections 15050. Installed tests for heating and ventilation systems shall be as specified in Section 15700. Installed tests for electrical and instrumentation devices and systems shall be in accordance with Division 16.

No tests specified herein shall be applied until the item to be tested has been inspected and approval given for the application of such test.

Tests and inspection shall include:

- a. The delivery acceptance test and inspections.
- b. The installed tests and inspections. These tests may be performed with water or the process fluid, as described in the accepted test plan.
- c. The operational testing of completed sections of the facility. These tests may be performed with water or the process fluid, as described in the accepted test plan.
- d. The commissioning of completed sections of the facility by Owner's personnel. The commissioning shall be performed with the process fluid at normal flows.

Tests and inspections, unless otherwise specified or accepted, shall be in accordance with the recognized standards of the industry. The Contractor shall see that scheduling and performance of all tests are coordinated with involved subcontractors and suppliers. The Contractor shall allow for up to two additional setpoint changes during testing. No extra costs or time allowances shall be provided as long as this setpoint allowance is not exceeded.

The form of evidence of satisfactory fulfillment of delivery acceptance test and inspection requirements shall be, at the discretion of the Engineer, either by tests and inspections carried out in their presence or by certificates or reports of tests and inspections carried out by approved persons or organizations. The Contractor shall provide and use forms that include all test information, including specified operational parameters. The content of the forms used shall be acceptable to the Engineer.

A master test log book shall be maintained by the Contractor, which shall cover all tests including piping, equipment, electrical, and instrumentation. The master test log book shall be provided with loose-leaf pages that shall be copied weekly after updating for transmittal to the Engineer. The master test log book shall be transmitted to the Engineer upon completion of the project.

2. Delivery Acceptance Tests and Inspections

The delivery acceptance tests and inspections shall be at the Contractor's expense for any equipment specified herein and shall include the following:

- a. Test of items at the place of manufacture during and/or on completion of manufacture, comprising hydraulic pressure tests, electric and instrumentation subsystems tests, performance and operating tests and inspections in accordance with the relevant standards of the industry and more particularly as detailed in individual clauses of these Specifications to satisfy the Engineer that the items tested and inspected comply with the requirements of this Contract. Tests other than those specified shall be in accordance with Section 01400.
- b. Inspection of all items delivered at the site or to any authorized place of storage so that the Engineer may be satisfied that such items are of the specified quality and workmanship and are in good order and condition at the time of delivery. The Contractor shall be prepared to remove all coverings, containers, or crates to permit the Engineer to conduct their inspection. Should the Engineer find, in their opinion, indication of damage or deficient quality of workmanship, the Contractor shall provide the necessary documentation or conduct such tests deemed necessary by the Engineer to demonstrate compliance.

3. Installed Tests and Inspections

a. General

All equipment shall be tested by the Contractor to the satisfaction of the Engineer before any facility is put into operation. Tests shall be as specified herein and shall be made to determine whether the equipment has been properly assembled, aligned, adjusted and connected. Any changes, adjustments, or replacements required to make the equipment operate as specified shall be carried out by the Contractor as part of the work.

b. Procedures

i. General

The procedures shall be divided into two distinct stages; preoperation checkout and water test. Testing procedures shall be designed to duplicate, as nearly as possible, all conditions of operation and shall be carefully selected to ensure that the equipment is not damaged. Once the testing procedures have been reviewed and approved by the Engineer, the Contractor shall produce checkout, alignment, adjustment and calibration sign-off forms for each item of equipment to be used in the field by the Contractor and the Engineer jointly to ensure that each item of electrical, mechanical and instrumentation equipment has been properly installed and tested. The Contractor is advised that failure to observe these precautions may place the acceptability of the subject equipment in question.

ii. Pre-operation Checkout

The installed tests and inspection procedures shall incorporate all requirements of these Specifications and shall proceed in a logical, step-wise sequence to ensure that all equipment has been properly serviced, aligned, connected, calibrated, and adjusted prior to operation. Preoperation checkout procedures shall include, but not necessarily be limited to:

- (1) Piping system pressure testing and cleaning as specified in Division 15.
- (2) Electrical system testing as specified in Division 16.
- (3) Alignment of equipment.
- (4) Preoperation lubrication.

iii. Water Test

Once all affected equipment has been subjected to the required preoperational checkout procedures and the Engineer has witnessed and has not found deficiencies in that portion of the work, individual systems may be started and operated under simulated operating conditions to determine as nearly as possible whether the equipment and systems meet the requirements of these Specifications. Test media for these systems shall either be the intended fluid or a compatible substitute. The equipment shall be operated a sufficient period of time to determine machine operating characteristics, including temperatures and vibration, to observe performance characteristics, including performance throughout the specified range for blowers, and to permit initial adjustment of operating controls. When testing requires the availability of auxiliary systems such as electrical power, compressed air, control air, or instrumentation which have not yet been placed in service, the Contractor shall provide acceptable substitute sources, capable of meeting the requirements of the machine, device, or system, at no additional cost to the Owner. Disposal methods for test media shall be subject to review by the Engineer.

If under test, any portion of the work should fail to fulfill the Contract requirements and is adjusted, altered, renewed or replaced, tests on that portion when so adjusted, altered, removed or replaced, together with all other portions of the work as are

affected thereby, shall, if so required by the Engineer, be repeated within reasonable time and in accordance with the specified conditions. The Contractor shall pay to the Owner all reasonable expenses incurred by the Owner as a result of repeating such tests.

Once simulated operation has been completed, all machines shall be rechecked for proper alignment, realigned, if necessary, and doweled in place. All equipment shall be checked for loose connections, unusual movement, excessive temperature, noise, and/or vibration or other indications of improper operating characteristics. Any deficiencies shall be corrected to the satisfaction of the Engineer. All machines or devices, which exhibit unusual or unacceptable operating characteristics shall be disassembled and inspected. They shall then be repaired or removed from the site and replaced at no cost to the Owner.

Test results shall be within the tolerances set forth in the detailed Specification sections of the Contract Documents. If no tolerances have been specified, test results shall conform to tolerances established by recognized industry practice. Where, in the case of an otherwise satisfactory installed test, any doubt, dispute, or difference should arise between the Engineer, and the Contractor regarding the test results or the methods or equipment used in the performance of such test, then, the Engineer may order the test to be repeated. If the repeat test, using such modified methods or equipment as the Engineer may require, substantially confirms the previous test, then all costs in connection with the repeat test will be paid by the Owner otherwise the costs shall be borne by the Contractor. Where the results of any installed test fail to comply with the Contract requirements for such test, then such repeat tests as may be necessary to achieve the Contract requirements shall be conducted by the Contractor at their expense.

Unless otherwise specified, the Contractor shall provide at no expense to the Owner, all water,

power, fuel, compressed air supplies, labor and all other necessary items and work required to complete all tests and inspection specified herein. The Contractor shall provide, at no expense to the Owner, temporary heating, ventilating, and air conditioning for any areas requiring it in the case where permanent facilities are not complete and operable at the time of installed tests and inspections. Temporary facilities shall be maintained until permanent systems are in service.

4. Operational Testing

After completion of all installed testing and review by the Engineer that all equipment complies with the requirements of the Specifications, the Contractor shall conduct operational testing. All domestic water, oil, fuel, and chemical systems shall be filled with the specified fluid.

The Contractor shall operate the completed facility for a period of not less than that specified in Part 3.4 of this Section during which all systems shall be operated as a complete facility at various loading conditions, as directed by the Engineer. Should the operational testing period be halted for any reason related to the facilities constructed or the equipment furnished under this Contract, or the Contractor's temporary testing systems, the operational testing program shall be repeated until the specified continuous period has been accomplished without interruption. All process units shall be brought to full operating conditions, including temperature, pressure, and flow.

Record drawings of facilities involved must be accepted and ready for turnover to the Owner at the time of operational testing.

All costs for water, fuel, power, and chemicals required during operational testing shall be borne by the Owner.

5. Commissioning

After completion of the operational testing and certifications by the Engineer that the systems meet all performance requirements, commissioning will begin. The commissioning period for all systems shall be 5 days. The Owner's operations and maintenance personnel will be responsible for operation of the facility or portion of the facility during this period of time. The facility or portion

thereof shall be fully and continuously operational, accepting all normal flow called for in design and performing all functions as designed.

The Contractor shall be available, with all appropriate subcontractors and trades, at all times during commissioning periods to provide immediate assistance in case of failure of any portion of the system being tested. This assistance shall be available, if needed, on a 24-hour basis. The Engineer will not issue a certificate of Substantial Completion until the end of the commissioning period (including training) and then only when all corrections required to assure a reliable and completely operational facility have been complete. The Contractor shall be responsible for all costs in excess of the Owner's normal expected costs of operations during the commissioning period. The Contractor shall bear the costs of all necessary repairs or replacements, including labor and materials, required to keep the portion of the plant being commissioned operational.

The commissioning period will be considered completed when the facility has been continuously operated without major interruption, equipment failure, or system breakdown for the specified commissioning period. A major interruption, failure or breakdown shall be a condition or event that prevents the facility from continuously and adequately handling normal flow, cannot be repaired or corrected immediately by the Contractor, and is not caused by improper operation and maintenance of the facilities by the Owner. An interruption of the commissioning period under these circumstances will require a re-start of commissioning once required repairs and corrections are made by the Contractor. Should the commissioning period be halted for any reason related to the facilities constructed or the equipment furnished under this Contract, the commissioning shall be repeated until the specified continuous period has been accomplished without interruption.

Final O&M manuals for the facilities must be accepted and ready for turnover to the Owner before the start of commissioning.

C. TRAINING

During the phase of water testing of equipment, the Contractor shall make available experienced factory-trained representatives of the manufacturers of all the various pieces of equipment, to train the Owner's personnel in the operation and maintenance thereof. The time required for this training shall be as covered in the specifications for the specific piece of

equipment. The Contractor shall notify the Engineer of the time of the training at least 10 days prior to the start time of the training.

1.4 SUBMITTALS

A. STARTUP AND TESTING PLAN

Prior to receipt of any progress payments in excess of 60 percent of the Contractor's total bid for the work, the Contractor shall submit to the Engineer five copies of a startup and testing plan with details of the installed tests and inspection procedures he proposes to adopt for testing and startup of all equipment to be operated singly and together.

B. TRAINING OUTLINE

The Contractor shall submit five copies of a detailed outline of training activities to be performed by each manufacturer's representative 10 days prior to the start time of the training. This outline shall indicate how the manufacturer's representative is going to allocate the required specified number of training hours to fulfill these contractual obligations.

PART 2 PRODUCTS

2.1 INSTALLATION

Materials employed in the installation shall conform to the requirements of the Contract Documents and the recommendations of the equipment manufacturers.

2.2 TESTING

A. GAUGES, METERS, RECORDERS, AND MONITORS

Gauges, meters, recorders, and monitors shall be provided by the Contractor as required to supplement or augment the instrumentation system provided under this Contract to properly demonstrate that all equipment fully satisfies the requirements of the Specifications. All devices employed for the purpose of measuring the performance of the facility's equipment and systems shall be specifically selected to be consistent with the variables to be monitored. All instruments shall be recently calibrated, and the Contractor shall be prepared at all times to demonstrate, through recalibration, the accuracy of all instruments employed for testing purposes. Calibration procedures shall be in accordance with applicable standards of ASTM, ISA, and IEEE. The adequacy of all gauges, meters, recorders and monitors shall be subject to review by the Engineer.

B. RECORDS

The Contractor shall provide sign-off forms for all installed and operational testing to be accomplished under this Contract. Sign-off forms shall be provided for each item of mechanical, electrical and instrumentation equipment provided or installed under this Contract and shall contain provisions for recording relevant performance data for original testing and not less than three retests. Separate sections shall be provided to record values for the preoperation checkout, as well as signatures of representatives of the equipment manufacturers, the Contractor, and the Engineer.

C. TEMPORARY TEST FACILITIES AND MODIFICATIONS

The Contractor shall provide and install all necessary temporary piping, valves, pumps, tanks, controls, and other facilities and modifications to enable the operational testing of the permanent facility components. Operational testing requiring the recirculation of water or process fluids within the facility shall be performed by the Contractor using temporary facilities, if needed, provided and installed by the Contractor. Temporary facilities shall be removed by the Contractor once the required testing is completed.

PART 3 EXECUTION

3.1 INSTALLATION

All equipment and apparatus used in testing shall be installed by specialists properly skilled in the trades and professions required to assure first-class workmanship. Where required by detailed Specifications, the Contractor shall cause the installation of specific equipment testing items to be accomplished under the supervision of factory-trained installation specialists furnished by the equipment manufacturers. The Contractor shall be prepared to document the skills and training of all workmen engaged in the installation of all testing equipment furnished either by the Contractor or the Owner.

3.2 TESTING

Testing shall proceed on a step-by-step basis in accordance with the Contractor's written testing procedures. The Contractor's testing work shall be accomplished by a skilled team of specialists under the direction of a coordinator whose sole responsibility shall be the orderly, systematic testing of all equipment, systems, structures, and the complete facility as a unit. Each individual step in the procedures shall be witnessed by a representative of the Engineer.

During the facility operational testing period, all equipment and systems in operation shall be operated to the greatest extent practicable, at conditions, which represent the full range of operating parameters as defined by the Contract Documents.

3.3 TRAINING

Training of the Owner's personnel shall be done by experienced technical manufacturers' representatives. Training shall be provided during a scheduled, dedicated session and shall not be combined with other field services such as equipment testing, startup and check-out. When required by these specifications, the training sessions shall be video and audio-taped by the Contractor and the final DVD delivered to the Owner. These manufacturers' representatives shall follow the outline presented here:

GENERAL OUTLINE FOR MANUFACTURER PRESENTATIONS

A. FAMILIARIZATION

1. Overview explaining theory of operation.
2. Show catalog, parts lists, drawings, etc., in the shop drawings and O&M manuals. Clearly identify the model or identification number of the equipment for which training is being provided.
3. Check out the installation of the specific equipment items.
4. Demonstrate the unit and show that all parts of the Specifications are met.
5. Answer questions.

B. SAFETY

1. Point out safety references.
2. Discuss proper precautions around equipment.

C. OPERATION

1. Point out reference literature.
2. Explain all modes of operation (including emergency).

3. Check out Owner's personnel on proper use of the equipment.
(Let them do it).

D. PREVENTIVE MAINTENANCE (PM)

1. Pass out PM list including:
 - a. Reference material.
 - b. Daily, weekly, monthly, quarterly, semi-annual, and annual jobs.
2. Show how to perform PM jobs.
3. Show Owner's personnel what to look for as indicators of equipment problems.

E. CORRECTIVE MAINTENANCE

1. List possible problems.
2. Discuss repairs - point out special problems.
3. Open up equipment and demonstrate procedures, where practical.

F. PARTS

1. Show how to use parts list and order parts.
2. Check over spare parts on hand. Make recommendations.

G. LOCAL REPRESENTATIVES

1. Where to order parts: Name, address, telephone, fax, e-mail.
2. Service problems:
 - a. Who to call.
 - b. How to get emergency help.

***** END OF SECTION *****

DIVISION 2

SITEWORK

SECTION 02050

LOCATE EXISTING UTILITIES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the anticipated conflicts, which may exist with existing utilities. A reasonable attempt has been made to locate the existing utilities; however, the exact location, and/or depth are unknown in most instances. Locations and dimensions shown in the Plans for existing facilities are in accordance with available information obtained without uncovering, measuring, or other verification. It shall be the responsibility of the Contractor to locate existing utilities and their depth.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
02250	Temporary Shoring and Bracing
02300	Earthwork

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall determine the difficulties to be encountered in constructing the Project and his locate effort based upon the information provided on the Plans, field investigation, and the Contractor's contacts with the existing utility companies. The Contractor shall determine the extent of exploration required to first prevent damage to those existing utilities, and secondly to determine if the proposed improvements are in conflict with existing utilities.

The Contractor shall locate existing utilities sufficiently ahead of construction so that the Engineer can modify the alignment, or grade prior to construction. Where underground utilities are found to be in the way of construction, such condition shall not be deemed to be a changed or differing site condition. If necessary, pipe alignment or grade shall be modified at the Contractor's expense.

The Contractor shall call the Utility Location Request Center (One Call Center), for field location, not less than 2 nor more than 10 business days before the scheduled date for commencement of excavation that may affect underground utility facilities, unless otherwise agreed upon by the parties involved. A business day is defined as any day other than Saturday, Sunday, or a legal local, State, or Federal holiday. The telephone number for the One Call Center for this project is (800) 424-5555. If no one-number locator service is available, notice shall be provided individually to those owners known to or suspected of having underground facilities within the area of the proposed excavation.

The Contractor is alerted to the existence of Chapter 19.122 RCW, a law relating to underground utilities. Any cost to the Contractor incurred as a result of this law shall be at the Contractor's expense.

No excavation shall begin until all know facilities in the vicinity of the excavation area have been located and marked.

***** END OF SECTION *****

SECTION 02230

CLEARING AND GRUBBING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the clearing, grubbing, and stripping of the proposed project areas in preparation of foundations, embankment construction, and pipeline installation.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
02305	Wet Weather Earthwork
02300	Earthwork
02370	Erosion Control

1.3 DEFINITIONS

“Clearing, grubbing, and stripping debris” as hereinafter used shall be considered as all material removed by the clearing, grubbing, and stripping operations.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 DISPOSAL OF CLEARING AND GRUBBING DEBRIS

Clearing and grubbing debris shall be disposed of by hauling to waste and disposal sites approved by the Owner.

3.2 CLEARING AND GRUBBING

Clearing and grubbing shall be performed as required to complete the work shown on the Plans to a minimum depth of 8 inches in order to remove the root zone of existing vegetation.

This work shall include removal and disposal of all trees, logs, brush, stumps, roots, and minor manmade structures to include but not limited to concrete, asphalt abandoned metal and equipment, rubbish and debris to the limits indicated on the plans or as required and approved by the owner. This work shall be to a depth necessary to remove stumps, large roots and all other objectionable material. This work shall also include the protection from injury or defacement of trees, bushes, shrubs, and other objects designated to remain.

***** END OF SECTION *****

SECTION 02250

TEMPORARY SHORING AND BRACING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the temporary shoring and bracing for excavations including the trench excavation safety systems as shown on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
02300	Earthwork
02511	Connection to Existing System
02530	Utility Structures
02534	Storm Sewers – Utility
15050	Piping Systems

1.3 SUBSURFACE CONDITIONS

Two test borings were drilled on the proposed reservoir and booster pump station site as part of the design process for this project. Results from these borings are provided in the Appendix C.

1.4 WORK INCLUDED

The extent of temporary shoring and bracing work includes, but is not limited to:

- A. Temporary shoring and bracing necessary to protect the following against loss of ground or caving embankments: existing structures, buildings, roads, walkways, utilities, electrical transmission towers and support wiring, other facilities and improvements where required to comply with codes and authorities having jurisdiction.
- B. Trench excavation safety systems, pursuant to RCW Chapter 49.17 and WAC 296-155-655.
- C. Maintenance of shoring and bracing.

1.5 QUALITY ASSURANCE

A. SHORING CONSULTANT

The Contractor shall engage the services of a qualified geotechnical engineer and qualified structural engineer registered in the State of Washington to design temporary shoring and bracing when required by applicable regulations.

B. SHORING DESIGN

The Contractor shall provide layout and design drawings and specifications for shoring and bracing when a trench box is inadequate for the purpose or will not be used and trench depth exceeds 4 feet and back sloping will not be used. Temporary shoring and bracing system design and calculations shall be prepared, stamped, and signed by a Professional Engineer registered in the State of Washington.

C. REGULATIONS

The Contractor shall design sheeting, shoring and bracing in accordance with the Washington State Safety Code and any local codes and ordinances of governing authorities having jurisdiction.

1.6 SUBMITTALS

The Contractor shall submit shoring and bracing layout and design drawings, calculations and other backup data to the Owner for review in accordance with Section 01300 prior to the start of construction.

1.7 PROJECT CONDITIONS

A. SITE SURVEY

The background survey information provided on the Plans is shown for clarity only. The Contractor shall determine, before commencing work, the exact location of all existing features that may be disrupted by new construction, including existing underground utilities. The Contractor shall be fully responsible for any and all damages, which might be caused by the Contractor's failure to exactly locate and/or preserve existing site features. Prior to commencing work, the Contractor shall check and verify governing dimensions and elevations.

The Contractor shall survey adjacent structures and facilities, establishing exact elevations at fixed points to act as temporary bench marks to

monitor potential settlement from the contractor's ongoing operations. Clearly identify temporary bench marks and record existing elevations from the control points shown on the Plans.

During excavation, the Contractor shall resurvey bench marks weekly. The Contractor shall maintain and make available at the job site an accurate log of surveyed elevations for comparison with original elevations, and promptly notify the Owner if changes in elevations occur or if cracks, sags or other damage is evident.

1.8 EXISTING UTILITIES

The Contractor shall protect existing active sewer, water, gas, electrical, and other utility services and structures that may be present. This shall also include all pipelines, services, and structures that are the property of the Owner.

PART 2 PRODUCTS

The Contractor shall provide suitable shoring and bracing materials, which shall support loads imposed. Materials for shoring systems need not be new, but shall be in serviceable conditions.

PART 3 EXCAVATION

3.1 VERIFICATION OF CONDITIONS

The Contractor shall notify the Owner immediately if, during construction, subsurface conditions are different from those encountered in the exploratory holes.

3.2 INSTALLATION AND APPLICATION

The Contractor shall provide shoring systems adequately anchored and braced to resist earth and hydrostatic pressures at locations as needed to support excavations during construction. The Contractor shall locate required bracing to clear all permanent work. Bracing which must be relocated shall be installed prior to the removal of original bracing. The Contractor shall not place bracing where it will be cast into or included in permanent concrete work, except as otherwise acceptable to the Owner. The Contractor shall maintain bracing until structural elements are rebraced by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.3 REMOVAL

The Contractor shall remove shoring and bracing in stages to avoid disturbances to adjacent and underlying soils and damage to structures, pavements, facilities and utilities. The Contractor shall repair or replace, as acceptable to the Owner, adjacent work damaged or displaced through the installation or removal of shoring and bracing work.

3.4 EXCAVATION SAFETY SYSTEMS

All work shall be carried out with due regard for public safety. Open trenches shall have proper barricades and at night they shall be distinctly indicated by adequately placed lights, as provided for elsewhere in the Specifications.

The Contractor is reminded that the Owner has not so delegated, and the Owner's Representative does not purport to be a trench or excavation system safety expert, is not so engaged in that capacity under this Contract, and has neither the authority nor the responsibility to enforce construction, safety laws, rules, regulations, or procedures or to order the stoppage of work for claimed violations of trench or excavation safety.

The furnishing by the Owner of resident representation and inspection personnel shall not make the Owner responsible for the enforcement of such laws, rules, regulations, or procedures, nor shall such make the Owner responsible for construction means, methods, techniques, sequences, procedures, or for the Contractor's failure to properly perform the work necessary for proper trench and excavation safety.

***** END OF SECTION *****

SECTION 02300

EARTHWORK

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the earthwork, including trench excavation and backfill for piping, excavation and backfill for structures, and finish grading.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
01500	Temporary Facilities
02250	Temporary Shoring and Bracing
02370	Erosion Control
02510	Disinfection
02700	Gravel Materials

PART 2 PRODUCTS

2.1 GRAVEL MATERIALS

All gravel materials shall conform to Section 02700.

PART 3 EXECUTION

3.1 PREPARATION

Excavation may commence once all erosion control measures are in place in accordance with the Plans and Section 02370 and to the satisfaction of the Owner.

3.2 GENERAL REQUIREMENTS

Excavation, compaction and backfill for structures, pipelines and the final site contours shall be formed by either excavating or compacting fill, as required, to provide the cross-sections as shown on the Plans.

All excavation performed on this Project shall be considered unclassified. Excavation shall consist of the removal of any and all material encountered, including debris, rubble, concrete, metal, topsoil, cutting and removal of existing

surfacing, tree stumps, trees, logs, abandoned rail ties, abandoned piping, piling, riprap, etc.

Excavations shall be kept free of water, both surface water and groundwater, during the excavation, installation of pipelines and structures, and the placement of backfill.

The Contractor's attention is also called to the depth of the structures and piping; for this reason, special shoring and bracing may be required. All shoring and bracing or sheeting required to perform and protect the excavation and to safeguard the employees, shall be furnished by the Contractor. For additional requirements see Section 02250.

No timber bracing, lagging, sheathing or other lumber shall be left in any excavation except with permission of the Engineer and in the event such permission is granted, no separate payment shall be allowed for burying such material.

All stockpiles shall be covered with plastic and no stockpile shall be higher than 6 feet above existing grade.

3.3 EXCAVATION AND BACKFILL FOR STRUCTURES

Excavation and backfill for structures shall be in conformance with Section 2-09 of the WSDOT Standard Specifications, and as further described herein. All excavation for structures shall be done to the dimensions and levels indicated on the Plans or specified herein. Excavation shall be made to such width outside the lines of the structures to be constructed as may be required for proper working methods, the erection of forms and the protection of the work.

Excavation shall consist of the removal of any and all material encountered to the elevations shown on the Plans. Excavations for structures shall be continued down to the subgrade which is defined as 12 inches below concrete mat foundations, concrete footings, and slab on grade floors for the installation of foundation gravel material, unless otherwise noted on the Plans.

Fill material placed under structures, including footings and floor slabs, shall be foundation gravel free from debris and organics, as specified in Section 02700.

In the event unsuitable material is encountered below the subgrade shown on the Plans and described herein, the Contractor, as required by the Engineer, shall over-excavate until a suitable foundation is reached. If over-excavation of unsuitable material is required by the Engineer, it will be under the unit price bid item entitled "UNSUITABLE EXCAVATION," as described in Section 01200.

The Contractor shall then replace the material with compacted foundation gravel,

as specified in Section 02700. If imported foundation gravel is required; it will be paid under the unit price bid item titled "FOUNDATION GRAVEL", as specified in Section 01200. Quantities, if any, shall be calculated by neat line measurement to the depth agreed to in the field by the Engineer.

The Contractor shall notify the Engineer when excavation for compacted fill or structures is complete. No forms, reinforcing steel, or concrete shall be placed until the excavation has been inspected by the Engineer.

Backfill for structures shall be suitable native material, free of organics and particles greater than 4 inches or Bank Run Gravel as specified in Section 02700.

There is no warranty that the native material is suitable for backfill or is suitable, as excavated, for placement and compaction as required by these Specifications. In the event that the Contractor is unable to find onsite, sufficient native material to accomplish the structure backfilling, the select material that he shall furnish and install shall be Bank Run Gravel, as specified in Section 02700.

3.4 PROTECTION OF FOUNDATION SURFACES

Care shall be taken to preserve the foundation surfaces shown on the Plans in an undisturbed condition. If the Contractor unnecessarily over excavates or disturbs the foundation surfaces shown on the Plans or specified herein without written authorization of the Engineer the Contractor shall replace such foundations with concrete fill or other suitable material approved by the Owner in a manner which will show by test an equal bearing capacity with the undisturbed foundation material. No additional payment shall be made for the added quantity of concrete fill or other suitable material used because of unnecessary over excavation caused by the Contractor or their operations.

3.5 EXCAVATION AND BACKFILL FOR TRENCHES

Excavation and backfill for trenches shall be in conformance with Sections 7-08 and 7-09 of the WSDOT Standard Specifications, and as further described herein. The following pipe materials shall be considered flexible:

- PVC
- Polyethylene Tubing
- Polyethylene

All other pipe materials shall be considered rigid.

Upon completion of work each day, all pipeline open trenches shall be completely backfilled, leveled, and temporarily patched or graveled, as herein specified.

Under certain conditions, the trench may be left open at the last length of pipe laid

during the day to avoid re-excavation the following morning, provided that the opening is adequately plated or covered for vehicle traffic. Special attention shall be given to barricading to keep vehicular traffic away from newly-backfilled trench areas until restored for traffic.

The Engineer reserves the right to restrict the Contractor in the amount of trench for pipeline that can be opened during the working day. Should the Contractor, in the Engineer's opinion, fail to diligently pursue backfilling, an allowable limit of open trench shall be 100 lineal feet and shall be strictly enforced.

The width of the trench at or below a point 12 inches above the top of the outside diameter of the pipe shall be carefully controlled and maintained to ensure the strength of the pipe and prevent pipe failures. Backfilling shall proceed as follows:

A. SUBGRADE PREPARATION

The subgrade for piping is defined as the elevation of the bottom of the pipe bedding material as shown on the Plans.

In the event unsuitable material is encountered below the subgrade shown on the Plans and described herein, the Contractor, as required by the Engineer, shall over-excavate until a suitable foundation is reached. If over-excavation of unsuitable material is required by the Engineer, it will be paid for under the unit price bid item entitled "UNSUITABLE EXCAVATION," as found in the Proposal. The Contractor shall then replace the material with compacted foundation gravel, as specified in Section 02700.

Quantities, if any, shall be calculated by neat line measurement to the depth agreed to in the field by the Engineer.

B. BEDDING FOR RIGID PIPE

Above the foundation material, if any, the bedding material shall be suitable native or Gravel Backfill for Pipe Bedding, as specified in Section 02700. This material shall be placed in lifts of approximately 8 inches up to a point 12 inches above the pipe. This material shall be hand shoveled in place and carefully worked under and around the pipe.

C. BEDDING FOR FLEXIBLE PIPE

Above the foundation material, if any, Gravel Backfill for pipe bedding, as specified in Section 02700, shall be placed in lifts of approximately

8 inches up to a point 12 inches above the pipe. This material shall be hand shoveled in place and carefully worked under and around the pipe.

D. BACKFILL FOR TRENCHES

Partial backfill to protect the pipe will be permitted immediately after the pipe has been properly laid in accordance with the Plans and these Specifications. Complete backfilling of trenches will not be permitted until the section of pipe installed has been inspected by the Engineer.

From the point 12 inches above the top of the pipe barrel, the backfill material to be used in the trench section shall be suitable native material or Bank Run Gravel, as specified in Section 02700, except where required or shown on the Plans to use other material. The Contractor shall place backfill in horizontal lifts not to exceed 8 inches in thickness. All backfill shall be free of large rocks, organic matter, stumps, trees, pieces of pavement, broken concrete and other deleterious substances.

The Contractor shall remedy, at their expense, any defects that appear in the backfill prior to final acceptance of the work. Cleanup operations shall progress immediately behind backfilling to accommodate the return to normal use of the trench area.

During placement of the initial lifts, the backfill material shall not be bulldozed into the trench or dropped directly over the pipe with less than 3 feet of backfill material above the top of the pipe.

3.6 ROCK EXCAVATION

It is not anticipated that solid rock will be encountered. Should such material be encountered, however, it will be paid for change order as directed by the Engineer and approved by the Owner. Boulders or broken rock less than 2 cubic yards in volume as measured in the field by the Engineer, will not be classified as rock, nor will so-called "hard-pan" or cemented gravel, even though it may be advantageous to use explosives in its removal if blasting were allowed. For the purpose of this contract, rock excavation shall be defined as mineral matter in place and of such hardness and texture that, when it is encountered, cannot be loosened by three passes of a ripper tooth mounted on the larger of a tracked backhoe of at least 25,000 pounds operating weight and 75 horsepower or the largest backhoe being utilized on the job by the Contractor. Where rocks occur as boulders that are smaller than the larger of: (1) 2 cubic yards in volume, or (2) the volume that can be readily handled by the largest backhoe being utilized on the job by the Contractor, they shall be considered incidental to excavation.

Where removal of a boulder results in a void below the desired elevation of the intended excavation, backfilling of the void shall be handled in the same manner as the replacement of unsuitable excavated material.

3.7 REUSE AND DISPOSAL OF EXCAVATED MATERIAL

Excavated materials shall be properly protected and reused where possible. Excavated materials not used for fill shall be hauled to an approved waste site(s), as selected by the Contractor. The Contractor shall submit a list of approved waste haul site(s) to the Owner prior to the commencement of hauling of waste materials. Any permits required for waste haul and disposal shall be the responsibility of the Contractor.

3.8 FINAL SITE GRADING

The site shall be graded consistent with the elevations shown on the Plans. The slopes between elevations shall be uniform or as shown on the Plans. Excavations and backfill shall be to the elevations required for the placement of all surface restorations, such as asphalt, concrete, gravel surfacing, or landscaping. All areas shall be graded to provide proper drainage. The final ground surface shall be smooth, raked free of debris and stones, and prepared for restoration as specified in Section 02900.

3.9 STRUCTURE COMPACTION

The foundation gravel material placed underneath all structures shall be moisture conditioned to within 3 percent of optimum moisture content and shall be placed in loose, horizontal layers. The thickness of layers placed before compaction shall not exceed 8 inches for heavy equipment compactors and shall not exceed 4 inches for hand-operated mechanical compactors. Water settlement is not allowed for compaction.

Layers shall be compacted to a dense state equaling at least 95 percent of the maximum dry density, using the Modified Proctor, per ASTM D1557. Prior to the placement of fill below structures, any and all groundwater and surface water shall be drained or pumped from areas to be filled.

Wall backfill material shall be compacted to at least 90 percent of the maximum dry density, using the Modified Proctor, per ASTM D1557 within 5 feet of all walls and shall be compacted to at least 95 percent of the maximum dry density, using the Modified Proctor, per ASTM D1557 beyond 5 feet of all walls. Any and all compaction within 5 feet of all walls shall be accomplished by means of hand-operated mechanical equipment rather than heavy equipment compactors.

3.10 TRENCH COMPACTION

Trench backfill materials shall be moisture conditions to within three percent of optimum moisture content. Water settlement is not allowed for compaction.

Pipe bedding materials, for both rigid and flexible pipes, shall be compacted to at least 95 percent of the maximum dry density, using the Modified Proctor, per ASTM D1557.

Compaction of the backfill above the bedding material in all trenches in non-structural and non-paved areas shall be performed by using mechanical equipment to at least 90 percent of the maximum dry density, using the Modified Proctor, per ASTM D1557.

Compaction of the backfill above the bedding material in all trenches in structural or paved areas shall be performed by using mechanical equipment to at least 95 percent of the maximum dry density, using the Modified Proctor, per ASTM D1557.

***** END OF SECTION *****

SECTION 02370

EROSION CONTROL

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the temporary erosion and sedimentation control (TESC) in and around the site caused by the actions of the Contractor as shown on the Plans and as specified herein.

Work under this Section shall be directed towards site areas disturbed during construction as well as all off-site storage and parking areas maintained by the Contractor.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01160	Regulatory Requirements
01200	Measurement and Payment
01300	Submittals
02300	Earthwork

1.3 SUBMITTALS

A. Stormwater Pollution Prevention Plan (SWPPP)

A SWPPP shall be prepared by the CESCL for the project and submittal in accordance with Section 01300 and paragraph 1.5 of this specification section. **The SWPPP shall be submitted to the Owner for approval at the preconstruction conference.**

1.4 CERTIFIED EROSION AND SEDIMENT CONTROL LEAD (CESCL)

The Contractor shall designate a Certified Erosion and Sediment Control Lead (CESCL) for this project. The CESCL shall have, for the life of this Contract, a current Certificate of Training in Construction Site Erosion and Spill Control signed by the WSDOT Water Quality Program Manager.

Duties of the CESCL shall include, but are not limited to:

- A. Inspecting temporary erosion and spill control Best Management Practice (BMPs) for proper location, installation, maintenance, and repair. Inspections shall be made as noted on the Plans and after each significant precipitation event, including those that occur during weekends and after working hours. A Temporary Erosion and Spill Control Inspection Report shall be prepared for each inspection and shall be included in the Temporary Erosion and Spill Control file. The inspection report shall include, but not be limited to:
 - 1. When BMPs are installed, removed or changed;
 - 2. Repairs needed or made;
 - 3. Turbidity monitoring results;
 - 4. Observations of BMP effectiveness and proper placement;
 - 5. Recommendations for improving performance of BMPs.
- B. Prepare and maintain a Temporary Erosion and Spill Control file on site that includes but is not limited to:
 - 1. Temporary Erosion and Spill Control Inspection Reports;
 - 2. Contractor's Stormwater Pollution Prevention Plan (SWPPP);
 - 3. Spill Prevention, Control, and Countermeasures (SPCC) Plan;
 - 4. All project permits, including but not limited to grading permits and Hydraulics Project Approval;
 - 5. Manufacturer instructions for all products used for TESC BMPs;
 - 6. Washington State Department of Ecology's Stormwater Management Manual for Western Washington, Chapter 4, Volume II, current edition.

1.5 STORMWATER POLLUTION PREVENTION PLAN

The CESCL Contractor shall be responsible for preparing a Stormwater Pollution Prevention Plan (SWPPP). The intent of the SWPPP is to reflect the Contractor's operations by supplementing the TESC Drawings, details, and notes shown on the Plans to provide comprehensive pollution control at the construction site, staging

areas, stockpiles, and borrow sites. The SWPPP shall be prepared by the CESCL for the project and submittal in accordance with Section 01300. The SWPPP shall be submitted to the Owner for approval at the preconstruction conference. **No work shall begin until the Contractor's SWPPP, as approved by the Owner, is implemented.** The SWPPP shall address, at least, the following items:

- Identification of construction haul routes and location of BMPs (e.g., stabilized construction entrance, silt fences, storm drain inlet protection).
- Waste disposal methods and locations.
- Detailed construction sequence and schedule, including identifying dates scheduled for BMP installation, removal, clearing, grading, seeding, and landscaping.
- Details for any temporary flow diversions, dewatering systems, and BMPs (in accordance with the current edition of the Washington State Department of Ecology's Stormwater Management Manual for Western Washington) proposed by the Contractor.
- Calculations for temporary sedimentation ponds, if used
- A list of products to be used, including Material Safety Data Sheets.
- Identification of stockpile and staging areas, and BMPs to be implemented at these locations.

The SWPPP shall be prepared in accordance with details shown on the Plans, these Specifications, and Chapter 4, Volume II Chapter 7 – BMPs from the current edition of the Washington State Department of Ecology's Stormwater Management Manual for Western Washington, which are hereby referenced and made a part of the Contract Documents. Only those sections of the Stormwater Management Manual for Western Washington that address preparation, implementation, and maintenance of permanent and temporary erosion and sedimentation control BMPs are applicable.

The SWPP shall include best management practices to control windblown dust.

PART 2 PRODUCTS

2.1 SILT FENCES

Silt fences shall conform to the details shown on the Plans and the fabric shall conform meet the requirements of Geotextile for Temporary Silt Fence of Section 9-33 of the WSDOT Standard Specifications.

2.2 STORM DRAIN INLET (CATCH BASIN) PROTECTION

Storm drain inlet protection shall be with a “silt sack,” as manufactured by ACF Environmental or equal.

2.3 WATTLES

Wattles shall conform to the details shown on the Plans and shall meet the requirements of Section 9-14.6(5) of the WSDOT Standard Specifications.

PART 3 EXECUTION

3.1 PREPARATION

Site preparation work shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture or other unsatisfactory conditions prevail, the work shall be stopped.

3.2 BEST MANAGEMENT PRACTICES (BMPS)

Silt fences and straw bale dams shall be constructed to control erosion and migration of soils disturbed during construction. The fences and dams shall provide temporary protection and shall be removed only upon approval of the Owner.

All areas or drainage ways downstream of the construction site shall have Best Management Practices (BMPs) installed prior to the beginning of any clearing activities. Runoff from cleared or disturbed area shall be directed through the BMPs. Disturbed ground shall be stabilized at the end of each work day. Permanent soil stabilization and erosion and sedimentation control shall be implemented upon reaching finish grade. Slope protection shall be immediately implemented upon any soils showing signs of erosion. This shall be done in a manner approved by the Owner.

All BMPs shall be inspected, maintained and kept in a condition sufficient to provide effective erosion and sedimentation control at all times. The site shall be inspected to ensure the BMPs are properly located, constructed and operating as designed during the first storm. Any necessary adjustments or repairs shall be made immediately and be approved by the Owner. The BMPs shall be inspected thereafter as noted on the Plans and after all significant storm events. Turbidity monitoring will be held on a weekly basis at a minimum, or more frequently if necessary as determined by the CESCL.

All BMPs shall be removed no later than 30 consecutive calendar days after final site stabilization has been achieved as determined by the Owner. BMPs such as storm drain inlet protection, straw bales, silt fences and supports and plastic coverings shall be removed and properly disposed of offsite by the Contractor. Areas disturbed by removal of these BMPs shall be immediately stabilized in a manner approved by the Owner.

***** END OF SECTION *****

SECTION 02500

WATER DISTRIBUTION

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes water pipe, valves, blowoffs, fittings and accessories described herein and as required for a complete installation as shown on the Plans.

Process piping and valves inside of Buildings and used for process or system control functions are specified in Section 15050 and 15100.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
01400	Quality Control
02250	Temporary Shoring and Bracing
02300	Earthwork
02510	Disinfection
02511	Connection to Existing System
15050	Piping Systems
15100	Valves

PART 2 PRODUCTS

2.1 GENERAL

Pipe sizes are nominal inside diameter unless otherwise noted.

All materials delivered to the job site shall be new, free from defects, and marked to identify the material, class, and other appropriate data such as thickness for piping.

Acceptance of materials shall be subject to strength and quality testing in addition to inspection of the complete product. Acceptance of installed piping systems shall be based on inspection and leakage tests as specified in Part 3 of this Section.

All water piping shall be certified under NSF 61 for potable water use.

2.2 PVC PIPE

All PVC pipe 4-inch and larger shall be PVC, Cast Iron pipe equivalent O.D., Class 235, conforming to the requirements of AWWA C900. Pipe joints shall be gasketed. Fittings for PVC pipe 4-inch and larger shall be ductile iron, as specified in Part 2.2 of this Section.

Bolts for PVC pipe, where required, shall be 316 stainless steel, ASTM A193, Grade B8M, hex head with ASTM A194, Grade 8M hex nuts. Washers of the same material shall be supplied.

All bolts, buried and unburied, shall be coated with Armite Anti-Seize Compound No. 609, or equal, prior to installation.

2.3 MISCELLANEOUS FITTINGS

A. FLEXIBLE COUPLINGS

Flexible couplings shall be Romac 501 or approved equal. Middle ring and follower shall have fusion bonded epoxy coating. All buried flexible couplings shall be furnished with stainless steel bolts and nuts.

B. FLANGED COUPLING ADAPTERS

Flanged coupling adapters shall be Smith-Blair Type 912 Dresser Style 127, or equal.

C. ADAPTER FLANGES

Adapter flanges for ductile iron pipe shall be manufactured of high strength ductile iron, ASTM A536, Grade 65-45-12. Flange dimensions shall be in accordance with ANSI B16.1, 125-pound pattern. Gasket shall be Buna-N. Setscrews shall be AISI 4140, high strength, low alloy steel. The adapter flanges shall be Uni-Flange Series 400, or equal.

D. RESTRAINED FLANGED COUPLING ADAPTERS

Restrained flanged coupling adapters shall comply with AWWA C219 and shall be manufactured of high-strength ductile iron, ASTM A536, Grade 64-45-12. Gaskets shall be compounded for water service in accordance with ASTM D2000. Restrained flanged coupling adapters shall be Smith-Blair Type 911, Romac RFCA, or equal.

E. DIELECTRIC INSULATED UNIONS

Dielectric insulated unions shall be used to connect dissimilar metals. They shall separate the metals so that the passage of more than one percent of the galvanic current, which would exist with metal to metal contact, is prevented. Unions shall be of the same material as the pipe to which attached, and pressure and temperature ratings shall be no lower than that of the piping system in which it is installed.

2.4 VALVE BOXES

Valve boxes shall be of cast iron, two-piece with tabs, adjustable with O-ring, minimum 5-inch inside diameter with base corresponding to the size of the valve. Valve box shall be painted with coal-tar epoxy by the manufacturer. Cover shall have the work "Water" cast into it. Valve boxes shall be Olympic Foundry No. 940 or equal.

2.5 DETECTABLE MARKING TAPE

The Contractor shall furnish and install detectable marking tape over all water mains and service pipes as shown on the Plans. The tape shall extend its full length. Detectable marking tape shall be as manufactured by Pro-Line Safety Products, or equal, and shall be a minimum of six inches in width, a minimum of 5 mil (0.0050") overall thickness, and shall have no less than 0.35 mil solid aluminum foil core.

The foil shall be visible from both sides of the tape and shall be Safety Blue in color to identify buried water systems and shall be printed to identify same. Printing shall be encased in the plastic jacket to avoid ink rub-off. Adhesives used to bond the plastic jacket to the foil shall not contain any dilutants, pigments, or contaminants and shall be specifically formulated to resist degradation by elements normally encountered in the soil.

In addition, the Contractor shall furnish and install 14-gauge coated copper wire, taped to the top of the water main and service pipe. The wire shall be brought up and tied off in valve boxes and meter boxes (as applicable).

2.6 FLEXIBLE EXPANSION COUPLINGS

A. Flexible expansion joints shall be installed in the locations indicated on the Plans and shall be manufactured of ductile iron conforming to the material requirements of ASTM A536 and ANSI/AWWA C153/A21.53. Foundry certifications of material shall be readily available upon request.

- B. Each flexible expansion joint shall be pressure tested prior to shipment against its own restraint to a minimum of 250 psi. A minimum 2:1 safety factor, determined from the published pressure rating, shall apply.
- C. Each flexible expansion joint shall consist of an expansion joint designed and cast as an integral part of a ball and socket type flexible joint, having a minimum per ball deflection of 20°, 12-inch minimum expansion. The flexible expansion fitting shall not expand or exert an axial imparting thrust under internal water pressure. The flexible expansion fitting shall not increase or decrease the internal water volume as the unit expands or contracts.
- D. All internal surfaces (wetted parts) shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C213. Sealing gaskets shall be construction of EPDM. The coating and gaskets shall meet ANSI/NSF-61.
- E. Exterior surfaces shall be coated with a minimum of 6 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C116/A21.16.
- F. Polyethylene sleeves, meeting ANSI/AWWA C105/A21.5, shall be included for direct buried applications.

PART 3 INSTALLATION

3.1 PIPE HANDLING

All types of pipe shall be handled in a manner that will prevent damage to the pipe, pipe lining, or coating.

Pipe and fittings shall be loaded and unloaded using hoists and slings in a manner to avoid shock or damage, and under no circumstances shall they be dropped, skidded, or rolled against other pipe. If any part of the coating or lining is damaged, repair thereof shall be made by the Contractor at no additional expense to the Owner and in a manner satisfactory to the Owner. Damaged pipe shall be rejected, and the Contractor shall immediately place damaged pipe apart from the undamaged and shall remove the damaged pipe from the site within 24 hours. Methods of pipe handling and storage shall be corrected by the Contractor should the Owner determine that these methods are damaging to the pipe.

Pipe shall be stacked in such a manner as to prevent damage to the pipe, to prevent dirt and debris from entering the pipe, and to prevent any movement of the pipe. The bottom tiers of the stack shall be kept off the ground on timbers, rails, or other similar supports.

Pipe shall not be strung across driveways, in ditches, or in the construction zone without specific on-site Owner approval.

Valves and fittings shall be stored on pallets or similar materials to keep them off the ground and prevent dirt and debris from entering them.

3.2 EXCAVATION

All earthwork, excavation, bedding, backfill and compaction shall meet the requirements of Section 02300.

3.3 DEWATERING

Dewatering of excavations, if necessary, shall meet the requirements of Section 02240.

3.4 TEMPORARY SHORING AND BRACING

Temporary shoring and bracing, including trench excavation safety systems, shall meet the requirements of Section 02250.

3.5 PIPE INSTALLATION (BELL AND SPIGOT)

All bell and spigot connections shall be made up in strict compliance with the manufacturer's recommendations and all pipe manufacture and handling shall meet or exceed the AWWA recommended specifications, current revisions.

Dirt or other foreign material shall be prevented from entering the pipe or pipe joint during handling or laying operations, and any pipe or fitting that has been installed with dirt or foreign material in it shall be removed, cleaned, and relayed. At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug or by other means approved by the Engineer to ensure cleanliness inside the pipe.

Pipe handling after the gasket has been affixed shall be carefully controlled to avoid disturbing the gasket and knocking it out of position, or loading it with dirt or other foreign material. Any gaskets so disturbed shall be removed, cleaned, re-lubricated if required, and replaced before the rejoining is attempted.

Care shall be taken to properly align the pipe before joints are entirely forced home. During insertion of the tongue or spigot, the pipe shall be partially supported by hand, sling or crane to minimize unequal lateral pressure on the gasket and to maintain concentricity until the gasket is properly positioned. Since most flexible gasketed joints tend to creep apart when the end pipe is deflected

and straightened, such movement shall be held to a minimum once the joint is home.

Sufficient pressure shall be applied in making the joint to assure that it is home, as described in the installation instructions provided by the pipe manufacturer. Sufficient restraint shall be applied to the line to assure that joints once home are held so, until fill material under and alongside the pipe has been sufficiently compacted. Restrained joint pipe and fittings shall be installed in accordance with the manufacturer's recommendations to provide the degrees of flexibility in the joint following installation.

3.6 CUTTING PIPE

Whenever it becomes necessary to cut a length of pipe, the cut shall be made by abrasive saw or by a special pipe cutter. Pipe ends shall be square with the longitudinal axis of the pipe and shall be reamed and otherwise smoothed so that good connections can be made. Oxyacetylene torch cutting of ductile iron pipe shall not be allowed.

The Contractor shall have the approval from the Owner and notification shall be given to the Owner before any pipe cutting on existing water mains will be allowed. The Contractor shall comply with all the conditions established by the Owner. The Contractor shall give the Owner a minimum notice of 48 hours before cutting any water main. No pipe cutting will be allowed on holidays or weekends, unless specifically agreed to by the Owner.

3.7 CONNECTION TO EXISTING SYSTEM

Connection to existing system work shall be as specified in Section 02511.

The Contractor shall notify (i.e., door hangers) all of the Owner's customers who will experience a scheduled service interruption. The notices shall be hand delivered not less than 48 hours or more than 72 hours before the scheduled "shut down."

3.8 CONCRETE THRUST BLOCKING

Fittings shall be adequately "blocked" with poured-in-place concrete, poured within wooden forms shaped to establish a firm minimum bearing area, against an undisturbed earth wall as shown on the Plans. Timber blocking or dry blocking will not be permitted.

Concrete thrust and/or anchor blocking, as indicated on the Plans, shall be placed at bends, tees, dead ends, crossed, and as designated by the Engineer. Blocking shall be 3,000 psi concrete mix cast in place.

All concrete thrust blocking configurations and sizes shall be per the Plans. The poured in place concrete thrust and/or anchor blocks shall be in place at least 24 hours before beginning the pressure test, to allow the concrete to set. Longer durations may be required to insure adequate curing has been established to conduct the necessary testing. All blocking dimensions shown on the Plans are considered as minimums with the ideal trench excavation results, and consideration shall be given to unusual circumstances, soil conditions, and topography.

All valves and all fittings requiring a concrete block shall first be covered with 4-mil Visqueen plastic sheets, before concrete is poured. At no time shall the concrete be allowed to cover joints, bolt heads, or nuts.

3.9 MECHANICAL JOINT PIPING

Mechanical joint piping shall be installed in best trade practice with torque wrenches used to avoid overstressing bolts. Piping shall be installed using recommended procedures outlined in "Handbook of Cast Iron Pipe" as published by Cast Iron Research Association which in part requires that all contact surfaces of rubber seal with pipe be wire brushed, spigot be centrally located in bell. When tightening bolts, it is essential that the gland be brought up toward pipe flange evenly, maintaining approximately same distance between gland and face of flange at all points around socket.

3.10 PIPE SUPPORTS

Provide all necessary supports, tie rods, bracing, brackets or other types of supports which may be required, as shown on the Plans.

3.11 FLEXIBLE COUPLINGS

Flexible couplings shall be installed in accordance with recommendations of manufacturer and used where shown on the Plans. Where flexible couplings are called for the space between pipe ends shall not exceed 1/4 inch. When the space between the pipe ends is excess, a short section of pipe may be inserted as space ring to limit pipe movement with the coupling to obtain the 1/4-inch limitation

3.12 VALVES

All valves shall be inspected in the field to ensure proper working order before installation. Valves shall be set and jointed to the pipe in the manner as set forth in the AWWA Standards for the type of connecting ends furnished.

Valves shall have the interiors cleaned of all foreign matter and shall be inspected both in open and closed position prior to installation. Valves and valve boxes shall be set plumb.

All valves with operating nuts located more than 3-feet below finished grade shall be equipped with extension stems to bring the operating nut to within 18 inches of the finished grade. The extension stem of the length required to meet field conditions shall be a manufactured unit with a 1-inch-diameter mild steel rod. At the top of the extension stem there shall be a 2-inch standard operating nut complete with a centering flange.

3.13 VALVE BOXES

The lower casting of the unit is installed first, in a manner as to be supported by a minimum backfill or by a Styrofoam collar not less than 2 inches in thickness. The casting shall not rest directly upon the body of the valve or upon the water main. Backfill shall be carefully tamped around the valve box to a distance of 3 feet on all sides or to the undisturbed face of the trench if it is closer. The cast iron valve box cover shall be set flush with the roadbed or finished paved surface.

The flared end of the valve box shall be set at the bottom elevation of the 2-inch operating nut to allow space for rocks to be moved laterally from the operation nut.

The valve box shall be placed over the valve or valve operator in such a manner that the valve box does not transmit shock or stress loads to the valve. The casting shall not rest directly upon the body of the valve or upon the water main.

The axis of the valve box shall be common with the projected axis of the valve stem. The tops of the adjustable valve boxes shall be set to the existing or established grade, whichever is applicable.

Valve boxes shall be set such that the slots in the boxes and/or ears in the valve box lid are in-line with the run of the pipe being installed.

In areas where the valve box is not in concrete or asphalt, a 24-inch-diameter by 4-inch cement concrete block shall be installed around the valve box at finished grade. The valve box shall be flush with the top, and centered.

3.14 PRESSURE TESTING

All pipelines shall be tested and disinfected prior to acceptance of work. All pumps, gauges, plugs, saddles, corporation stops, double check valve assemblies miscellaneous hose and piping, and measuring equipment necessary for performing the test shall be furnished, installed and operated by the Contractor.

The Contractor shall provide an oil-filled pressure gauge with a range of 0 to 300 psi.

All temporary connection to the existing water lines for filling or flushing new pipe lines shall be equipped with double check valve assemblies to prevent backflow into the existing waterline.

The pipeline shall be backfilled sufficiently to prevent movement of the pipe under pressure. All thrust blocks shall be in place and time allowed for the concrete to cure before testing.

All piping systems shall be tested to demonstrate leak tightness prior to acceptance. The Contractor shall provide all equipment and labor necessary to perform all testing required herein. Gauges used in testing shall be certified by an approved laboratory.

All water lines and appurtenances shall be tested at a pressure of 225 psi. Testing is to be done in sections between valves with no back pressure against the valves to ensure water tightness of the valves in either direction. Maximum differential allowed across closed butterfly valves is 150 psi.

The pipeline shall be backfilled sufficiently to prevent movement of the pipe under pressure. All thrust blocks shall be in place for at least 24 hours to allow concrete to cure before testing.

Prior to the acceptance test, the lines shall be filled and allowed to stand under pressure for a sufficient length of time to allow the escape of entrapped air and to allow any pipe lining to absorb water.

Testing will be done by pumping up the line to 225 psi and closing a valve between the pump and the line. The line shall be pumped back up to 225 psi at 15-minute intervals. The test shall be conducted for a period of two hours.

The quantity of water lost during the test period shall not exceed the number of gallons as determined by the following formula:

$$L = \frac{SD\sqrt{P}}{266,400}$$

Where

L=allowable leakage, gallons/hour
S=gross length of pipe tested, feet
D=nominal diameter of the pipe, inches

P=test pressure during the leakage test, psi

Make-up water shall be pumped from a container that will allow the amount of water pumped to be easily computed or verified.

There should be no appreciable loss of pressure during the 15-minute test intervals.

All leaks shall be repaired or defective material replaced and the test repeated as directed by the Engineer.

The Contractor shall be responsible for repair of any damage resulting from or caused by leak testing.

3.15 FLUSHING

Flushing shall be done through temporary taps. Water for flushing will be available from the Owner's system.

The pipes shall be flushed at a minimum velocity of at least 2.5 fps for a sufficient time to insure a minimum of 3 turnouts of water through the pipe.

The Contractor shall be responsible for the disposal of treated water flushed from the pipelines. The treated water shall be neutralized in accordance with the provisions of AWWA C651, Appendix B.

***** END OF SECTION *****

SECTION 02510

DISINFECTION

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes disinfection of potable water piping, distribution mains, filter basins, and structures; testing; and reporting results.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
Division 15	Mechanical

1.3 REFERENCES

- A. AWWA B300 - Standard for Hypochlorites.
- B. AWWA B301 - Standard for Liquid Chlorine.
- C. AWWA B302 - Standard for Ammonium Sulfate.
- D. AWWA B303 - Standard for Sodium Chlorite.
- E. AWWA C651 - Standards for Disinfecting Water Mains.

1.4 SUBMITTALS

- A. TEST REPORTS

Indicate results comparative to specified requirements.

1.5 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 01300.
- B. DISINFECTION REPORT; RECORD
 - 1. Type and form of disinfectant used.
 - 2. Date and time of disinfectant injection start and time of completion.

3. Test locations.
4. Initial and 24-hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
5. Date and time of flushing start and completion.
6. Disinfectant residual after flushing in ppm for each outlet tested.

C. BACTERIOLOGICAL REPORT; RECORD

1. Date issued, project name, and testing laboratory name, address, and telephone number.
2. Time and date of water sample collection.
3. Name of person collecting samples.
4. Test locations.
5. Initial and 24-hour disinfectant residuals in ppm for each outlet tested.
6. Coliform bacteria test results for each outlet tested.
7. Certification that water conforms, or fails to conform, to bacterial standards of the Department of Health.
8. Bacteriologist's signature and authority.

1.6 QUALITY ASSURANCE

Perform Work in accordance with AWWA C651.

1.7 REGULATORY REQUIREMENTS

Conform to Department of Health code or regulation for performing the work of this Section.

PART 2 PRODUCTS

2.1 DISINFECTION CHEMICALS

Chemicals: AWWA B300, Hypochlorite, AWWA B301, Liquid Chlorine, AWWA B302, Ammonium Sulfate, and AWWA B303, Sodium Chlorite.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that piping system has been cleaned, inspected, and pressure tested.
- B. Perform scheduling and disinfection activity prior to startup, testing, adjusting and balancing, demonstration procedures, including coordination with related systems.

3.2 WATER PIPE DISINFECTION

- A. Provide and attach required equipment to perform the work of this Section.
- B. Inject treatment disinfectant into piping system.
- C. Maintain disinfectant in system for 24 hours.
- D. Replace permanent system devices removed for disinfection.
- E. Water for disinfection must be obtained by the Contractor by arrangement with the Owner. The following describe specific procedures to be used by the Contractor in maintaining a satisfactory environment for prevention of contamination of the proposed water system installation, the cleanliness of the pipe and fittings and the actual method of disinfection.
- F. When the line is completed and ready to disinfect, water shall be allowed to flow in slowly, until it appears at the far end of the line so as not to displace the disinfecting agent. The system shall then be allowed to stand for at least 24 hours. The line shall then be flushed through the drain stations until a test shows no more than two parts per million of available chlorine.
- G. In all instances, the Contractor shall utilize a state approved double check valve type backflow prevention device to protect the potable water supply while filling, flushing and disinfecting the particular water main.
- H. Where connections are made to existing facilities and it is impractical to use the methods described herein to disinfect the section between the existing water main and the point of isolation of the new water main (valve or temporarily plugged line) or where pipes and fittings require immediate use, cleaning and disinfecting shall be directed by the Owner.

- I. The Contractor is herein advised that prior to making any restorations or permanent connections to the existing water mains, that the Contractor shall first demonstrate to the Owner, that the new water main has adequately passed a pressure test, been adequately flushed, and finally passed the required bacteriological test.
- J. In all disinfection processes, the Contractor shall take particular care in flushing and wasting the chlorinated water from the mains to assure that the flushed and chlorinated water does no physical or environmental damage to property, streams, storm sewers or any waterways. The Contractor shall chemically or otherwise treat the chlorinated water to prevent damage to the effected environment, particularly aquatic and fish life of receiving streams. The method and the time of flushing is to be approved by the Owner.
- K. Before placing the lines in service, satisfactory results must be obtained on samples collected from representative points in the new system and submitted to a State DOH approved laboratory. The Owner shall collect all samples for the bacteriological tests. However, the Contractor shall notify the Owner for collection of samples two days in advance, and schedule on days wherein samples can be conveniently processed by State DOH approved laboratory. If any of the pipeline materials are replaced thereafter, then that section shall again be disinfected and tested for bacteriological count.

If disinfection of mains by the above methods, prove unsatisfactory and the lab report indicates any type of bacteria count, then the Owner may direct the Contractor to use one of the following two disinfection methods until a satisfactory report is obtained. No additional compensation will be made to the Contractor for any work necessary to achieve a satisfactory bacteriological test result.

L. METHOD 1

1. Calcium or Sodium Hypochlorite or Chlorinated Lime in Water

A mixture of either calcium or sodium hypochlorite or chlorinated lime of known chlorine content and water may be used. (Typical commercial products of this type are Perchloron (HDH), Multichlor, Purex, etc.)

2. Proportions of Chlorine Compound and Water Mixtures

Prepare a solution containing approximately 5 percent available chlorine by weight. In the case of Perchloron, at 70 percent

available chlorine, use 6 pounds per 10 gallons of water. In the case of 12.5 percent hypochlorite, add 2.5 parts water to 1 part of 12.5 percent hypochlorite. For other strength compounds, adjust the dilution accordingly.

3. Preparation of Chlorine Compound

To prepare the chlorine compound-mixture from a powder, first make a paste, and then thin to a slurry to ensure getting all active ingredients into solution. The prepared solution shall be injected by means of a hypochlorinator, or hand or engine operated pump. The rate chlorine-water mixture shall be in such proportion to the rate of water entering the newly laid pipe that the dose applied to the water entering the newly laid pipe will be at least 50 parts per million. A color comparator set shall be used to determine chlorine residual. For solutions containing approximately 5 percent available chlorine, the rate of bleeding the main to be sterilized should be 1,000 times the rate of feed or injection of the chlorine solution.

4. Cross-Connection Prevention

A cross-connection control device (DOH approved) shall be utilized to prevent potential cross-connections.

5. Retention Period

Treated water shall be retained in the pipe at least 24 hours. After this period, the chlorine residual at pipe extremities and at other representative points shall be at least 5 parts per million.

6. Chlorinating Valves and Hydrants

In the process of chlorinating newly laid water pipe, all valves or other appurtenances shall be operated while the pipeline is filled with the chlorinating agent.

7. Final Flushing and Chlorine Residual Test

Following chlorination, all treated water shall be thoroughly flushed from the newly laid pipe at its extremity until the replacement water throughout its length, upon test, shows the absence of chlorine (or in the event chlorine is normally used in the source of supply, then the tests shall show a residual not in excess

of that carried by the system). A state-approved bacteriological test shall then be conducted.

8. Repetition of Procedure

Should the initial treatment prove ineffective, the chlorination procedure shall be repeated until tests show that the water sample from the newly laid pipe conforms to the requirements of these Specifications.

3.3 RESERVOIR AND CLEARWELL DISINFECTION

Reservoirs and clearwell shall be disinfected in accordance with AWWA C652 (Disinfection of Water Storage Facilities).

Bacteriological sampling and testing shall be in complete compliance with AWWA C653-87 Section 5.3 and the requirements of the Washington State Department of Health.

3.4 QUALITY CONTROL

Samples shall be taken and tested in accordance with AWWA C651.

*****END OF SECTION*****

SECTION 02511

CONNECTION TO EXISTING SYSTEM

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the connection of pipelines being constructed under this project to existing water mains as shown on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
Division 15	Mechanical

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

All cut-in connections to the existing system shall be made after a successful pressure test of the new main has been witnessed by the Owner and after a purity test has been satisfactorily evidenced except as allowed by the Owner.

The location, type and size of existing facilities have been determined from available records and are approximate. It is anticipated that connections to these existing facilities may be made, in general, as shown on the Plans except adjustments may be required for vertical and horizontal alignment.

It shall be the responsibility of the Contractor to determine the exact location and ascertain the type and size of the existing facilities prior to starting work on each connection and to provide any alternations as required in the connection detail.

Connections to existing facilities shall be made with the use of fittings, valves, flexible couplings, solid sleeves, shackling and other miscellaneous fittings, and thrust blocks as shown on the or with additional pipe or fittings as approved by the Owner and as indicated in Piping Systems to connect the new construction under this Project to the existing pipelines.

All pipe and fittings used for the connection shall be clean and disinfected with a minimum 5 percent chlorinated solution immediately prior to making said

connection. The Contractor shall take extra precautions to ensure the tightness of the connections, nuts, and bolts. The existing water main shall be placed back into service by the Owner and the connection observed by the Owner prior to backfilling the pipe.

All valves shall be operated by Owner personnel only. Where it is necessary to shut off the existing mains to make a connection, the Contractor shall notify the Owner and all water customers affected 48 hours in advance of such shut off, and the Owner will shut off the mains. Once the water has been shut off, the Contractor shall diligently pursue the connection to completion so that the time required for the shut off is held to a minimum.

All connections to existing mains shall be completed the same day as they are started. The Contractor shall time its operations so that the water will not be shut off overnight or over weekends or during holidays.

***** END OF SECTION *****

SECTION 02530

UTILITY STRUCTURES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes precast concrete vaults, manholes, catch basins, castings, and steps for a complete installation as shown on the Plans and specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
02300	Earthwork
08310	Access Hatches

PART 2 PRODUCTS

2.1 GENERAL

The exterior finish of all precast concrete utility structures shall be smooth with no imperfections larger than 1/8 inch in diameter. The interior finish of all precast concrete utility structures shall be smooth and sacked with non-shrink cementitious materials and epoxy bonding agent. No bug holes, fins, projections, or other defects are acceptable.

2.2 PRECAST VAULTS

Precast concrete vaults shall be cast in an established precast yard. Precast vaults shall be designed for H-20 loads. Submit design calculations and shop drawings for review and approval prior to fabrication. Shop drawings shall detail wall thickness, concrete strength, reinforcing requirements, and shall include all appurtenances, such as access hatches, floor drains, and other items called for on the Plans.

All vaults shall be constructed with a minimum of 4-inch-thick solid walls.

The access hatches shall be as specified in Section 08310.

2.3 RINGS AND COVERS

Castings for manhole rings shall be gray-iron conforming to the requirements of ASTM A48/AASHTO M105, Grade 30B. Covers shall be ductile iron conforming to ASTM A536, Grade 80-55-06. All rings and covers shall be of uniform quality, free from blowholes, porosity, shrinkage, distortion, cracks, or other defects. Repair of defects shall not be permitted. All mating surfaces shall be machined finished to ensure a nonrocking fit. All covers shall be interchangeable within the dimensions as shown on the Plans and marked "sewer," "drain," or "water" as appropriate. Locking/tamperproof covers shall be secured to the ring with three 5/8-inch stainless steel Allen head cap screws. When watertight covers are required the locking style ring and covers shall be used and include a machined groove in the seat of the ring or underside of the cover and a gasket installed to assure a watertight seal. Covers shall be without pickholes. The manufacturer's identification shall be cast with a minimum of 1/2-inch letters on exposed surfaces. Manhole rings and covers shall have a design wheel load conforming to AASHTO/ASTM A16 design loading HS20-44.

The frames and covers shall be made by Olympic Foundry, Inc., D&L Foundry, East Jordan Iron Works, or Neenah.

2.4 STEPS

Polypropylene manhole steps shall be made of a copolymer polypropylene, superior in its resistance to corrosion, meeting the requirements of ASTM D4101 Type II, Grade 16906, and shall completely encapsulate a deformed 1/2-inch steel reinforcing rod conforming to ASTM A615, Grade 60. Polypropylene steps shall be factory installed in complete accordance with the manufacturer's instructions. This shall be accomplished by predrilling two parallel 1-inch holes, 3-3/4-inch deep, and 13-inches on center in the cured concrete base, riser, and taper sections of the manhole. The insertion ends of the step shall be fully coated with non-shrink epoxy grout then driven into the holes to the prescribed depth. In no case will the predrilled hole be allowed to penetrate through the wall of the manhole section.

Steps shall be Lane International Corporation Manhole Step or equal.

2.5 PRECAST CONCRETE CATCH BASINS

Precast components shall conform to the requirements of ASTM C478. All Portland cement used in the manufacture of the precast sections shall conform to the requirements of ASTM C150 and shall be Type II or Type V.

Precast base sections for Type 2 catch basins shall conform to the requirements for precast riser sections. The base shall be a minimum of 6-inches thick

underneath the pipe invert. Catch basins Type 2 shall contain steps in accordance with Section 2.5.

Standard precast riser sections shall consist of circular sections in standard nominal inside diameter as shown on the Plans. Reinforcement shall be in accordance with ASTM C478. Type 1 risers shall be used. Minimum height of a riser section shall be 1 foot. The height of riser and base sections shall be arranged so no pipes pass through the joining surfaces.

Openings for pipe shall be circular, tapered toward the inside of the section, and shall be of the minimum size possible to accommodate the size of pipe to be inserted and to effectively seal the joint.

2.6 FRAMES AND GRATES

Castings for catch basin and inlet frames shall be gray-iron conforming to the requirements of ASTM A48/AASHTO M105, Grade 30B. Grates or solid covers shall be ductile iron conforming to ASTM A536, Grade 80-55-06. All frames and grates or covers shall be of uniform quality, free from blowholes, porosity, shrinkage, distortion, cracks, or other defects. Repair of defects shall not be permitted. All mating surfaces shall be seated properly to prevent rocking of the grate/cover. The frames, grates, and covers shall have a design wheel load conforming to AASHTO/ASTM A16 design loading HS20-44.

The frames and grates/covers shall be made by East Jordan Iron Works, Olympic Foundry, Inc., D&L Foundry, or Neenah.

2.7 GASKETS AND MANHOLE ADAPTERS

Rubber gaskets shall conform to Section 9-04.4 of the WSDOT Standard Specifications. Pipe connections to existing manholes shall be made using a heavy duty sand collar with gasket, head, or equal. Pipe connections to new manholes or vaults shall utilize an adaptor coupling with gasket or watertight flexible rubber boot, Kor-n-Seal or equal. The Contractor shall provide Kor-n-Seal cavity O-rings to fill the annular spaces between the pipe and the manhole or vault wall.

PART 3 EXECUTION

3.1 CATCH BASINS

Catch basin installation shall be as shown on the Plans. Precast sections with damaged joint surfaces or with cracks or damage that would permit infiltration shall not be installed.

Precast base sections shall be set on a prepared bedding material. Before the precast base is set, the gravel shall be carefully leveled to provide full bearing for the entire base slab.

The frame shall be set carefully to the established surface grade in a full bed of cement grout. The catch basin rim elevation shall be set flush with the pavement or improved areas.

3.2 PRECAST VAULTS

Precast vaults shall be installed as shown on the Plans and in accordance with the manufacturer's recommendations.

3.3 FINAL ADJUSTMENT AND CLEANUP

After installation is complete, the Contractor shall cleanout all precast structures prior to placing the new facilities into service. The adjustment of castings shall be done in a manner satisfactory to the Owner. Adjustment shall be done only with precast grade rings. Bricks are unacceptable. Grouting and final adjustment of castings shall be done with non-shrink grout.

***** END OF SECTION *****

SECTION 02700

GRAVEL MATERIALS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the various types of granular materials that are to be used in trenches and other excavations as shown on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
02300	Earthwork
02305	Wet Weather Earthwork
02710	Gravel Surfacing

1.3 SUBMITTALS

The Contractor shall provide certificates of laboratory tests in accordance with Section 01300, indicating particle size distribution for review for each type of granular material furnished and proctor test reports for all material to be placed as pipe bedding material, trench backfill, backfill under and around structures and underneath crushed surfacing and asphalt concrete pavements.

The certificates and proctor test reports shall be provided to the Owner at least 5 calendar days prior to placement.

PART 2 PRODUCTS

2.1 FOUNDATION GRAVEL

Foundation gravel shall be Class A Gravel Backfill for Foundations in conformance with Section 9-03.12(1)A of the WSDOT Standard Specifications.

2.2 BANK RUN GRAVEL

Bank run gravel shall be free from organic matter or other deleterious materials and in conformance with Section 9-03.19 of the WSDOT Standard Specifications.

2.3 CRUSHED SURFACING

Crushed surfacing base course and top course shall conform to Section 9-03.9(3) of the WSDOT Standard Specifications.

2.4 SPALLS

Quarry spalls shall conform to Section 9-13 of the WSDOT Standard Specifications. Materials used for quarry spalls shall meet the requirements of Section 9-13.1(5) of the WSDOT Standard Specifications, except that the size of material shall be revised as follows: 100 percent passing a 4-inch sieve size and 40 percent passing a 2-inch sieve size.

2.5 PEA GRAVEL

Pea gravel shall be relatively round, processed, washed rock conforming to ASTM C33 with the following sieve analysis.

Sieve Analysis (% Passing by Weight)	
Sieve Size	Percent Passing
1/2"	100
3/8"	85-100
No. 4	10-30
No. 8	0-10
No. 16	0-5

2.6 MISCELLANEOUS GRAVEL

If the Plans call for a gravel that is not herein specified than the gravel shall conform to the type of gravel called for as per the WSDOT Specifications.

PART 3 EXECUTION

3.1 FOUNDATION GRAVEL

Foundation gravel shall be placed and compacted underneath all structures to a minimum depth of 12 inches unless indicated otherwise on the Plans, and to a greater depth where foundations are unstable and excess suitable excavated material is unavailable to stabilize such foundations.

In the event the Contractor unnecessarily over excavates the pipe trench or structure foundation, or if the width of the pipe trench becomes wider than the pay limit shown on the Plans, all material so placed shall be at the Contractor's sole expense.

3.2 BANK RUN GRAVEL

Bank run gravel shall be used where excavated material is unsuitable or unavailable for the backfill of trenches as approved by the Owner.

In the event the Contractor over excavates the pipe trench, or if the width of the pipe trench becomes wider than the pay limit shown on the Plans, all material so placed shall be at the Contractor's sole expense.

3.3 CRUSHED SURFACING

Crushed surfacing base course and/or top course shall be placed underneath asphalt paving, to the lines and grades shown on the Plans or as required by the Plans and shall be compacted to a dense, unyielding state of at least 95 percent of the maximum dry density, using the modified Proctor, per ASTM D1557.

3.4 SPALLS

Quarry spalls shall be placed where shown on the Plans, where foundations are unsuitable if approved by the Owner or in other locations where approved by the Owner.

3.5 PEA GRAVEL

Pea gravel shall be placed as backfill around flexible expansion couplings as shown in the Plans, a minimum of 12 inches in all directions.

3.6 MISCELLANEOUS GRAVEL

Miscellaneous gravel shall be installed per the Plans.

***** END OF SECTION *****

SECTION 02710

GRAVEL SURFACING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the installation of crushed surfacing materials.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
02300	Earthwork
02700	Gravel Materials

1.3 SUBMITTALS

The Contractor shall provide the Owner with a certificate of laboratory test indicating gradation of each material provided in accordance with Section 01300. The certificate shall be provided to the Owner 5 calendar days prior to placement of any materials.

PART 2 PRODUCTS

2.1 GRAVEL MATERIALS

All gravel materials shall conform to the requirement of Section 02700.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

The subgrade shall be prepared as per Section 2-06.3 of the WSDOT Standard Specifications. As the rolling of the subgrade proceeds, all soft or spongy areas shall be removed and the resulting holes filled with ballast material or crushed surfacing base course as shown on the Plans. The Contractor shall dispose of excess materials resulting from the preparation of the subgrade. Rollers shall not be operated adjacent to structures where such use may cause damage. Where the subgrade abuts structures and compaction with a roller is not possible for practical reasons, the area shall be compacted with mechanical tampers or other approved equipment.

3.2 GRAVEL MATERIAL

Gravel materials shall be placed in the layers and thickness as shown on the Plans. Gravel materials shall be placed in accordance with Section 4-04.3 of the WSDOT Standard Specifications.

The Contractor shall place gravel materials in a uniform layer over the entire area to receive gravel materials without segregation of sizes, to such depth that when compacted with the power roller, the course shall have the required thickness. The maximum layer thickness for compaction with a roller shall be 6 inches for ballast or base course and 4 inches for crushed surfacing. The gravel material shall be bladed with a grader and rolled while damp with a power roller until the course is thoroughly and uniformly compacted and until its surface is smooth and conforms to grade and crown requirements shown on the Plans. The cross-section of the finished surface shall be subject to reasonable variations as approved by the Owner to meet the varying conditions encountered. The surface shall be maintained in its finished condition until the succeeding layer is placed.

The roller shall not be operated adjacent to structures where such use may cause damage. Where the gravel materials abuts structures and compaction with a roller is not possible for practical reasons, the area shall be compacted with mechanical tampers or other approved equipment.

3.3 COMPACTION

All materials shall be compacted to a dense, unyielding state of at least 95 percent of the maximum dry density, using the modified Proctor, per ASTM D1557.

*****END OF SECTION*****

SECTION 02820

CHAIN LINK FENCE AND GATES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the furnishing and installing of chain link fencing and gates conforming to the lines, grades, and details and at the locations as shown on the Plans.

The furnishing, installing, maintaining, and removing of temporary fencing and gates shall be provided to provide site safety, security, and protection at the project site. The temporary fencing is required to stay in place until the permanent fence is installed.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
03300	Cast-in-Place Concrete

PART 2 PRODUCTS

2.1 FENCING

Chain link fencing shall conform to Section 9-16 of the WSDOT Standard Specifications, and shall be a Type 3 fence per WSDOT Standard Plan, with the following exceptions. The fence shall have continuous chain link wire, tension wire and three strands of barbed wire supported on angled extension arms. The chain link shall have a 2-inch diamond mesh and 9-gauge wire, meeting ASTM 668, Class 2b. The chain link fence and all accessories shall be galvanized finish. The total height of the fence shall be as shown on the Plans. The fence shall be heavy steel guard fence with top rail and bottom tension wire. Top and bottom selvages of chain link fabric are to have a twisted and barbed finish.

Rails, posts, and accessories shall be galvanized with 1.8 ounces per square foot.

2.2 GATES

Gates shall be installed for the full opening shown on the Plans as per the manufacturer's recommendations. The Contractor shall furnish padlocks and keys for gates, which comply with Owner standards. Gates shall conform to WSDOT Standard plan L-30, the Plans, and ASTM F900.

Gate posts shall be provided in accordance with ASTM F900 and have a ball top.

PART 3 EXECUTION

3.1 TEMPORARY FENCING

The Contractor shall furnish and install temporary fencing around the site so as to protect the site and prevent unauthorized entry into the site. The Contractor shall also maintain the temporary fencing throughout the course of the construction and provide any and all security necessary for site safety and protection during periods when sections of the fence may be down or open. Temporary fencing shall be removed by the Contractor only after receiving written authorization from the Owner for its removal.

3.2 FENCING INSTALLATION

The chain link fencing shall be erected in straight lines between angle points by skilled workmen experienced in this type of construction, in accordance with the manufacturer's recommendations and these Specifications. The new fence installation shall not commence until final grading is complete and finish grade elevations are established. The new fence shall be constructed to provide security for the site. There shall not be any gaps between finish elevations and the bottom links of the fence, which would allow entrance into the site.

The site fence shall be constructed in conformance with Section 8-12 of the WSDOT Standard Specifications. The maximum spacing for line posts shall be 10-feet on center. Post holes shall be a minimum depth of 3 feet below finished grade; holes for line posts shall be 10 inches in diameter; holes for gate, corner, and pull posts shall be four times the diameter of the post. Posts shall be set plumb in true line and to the depth of 3 feet and the remainder of the hole filled with concrete that must extend around the posts to a point 2 inches above finished grade. The top surface shall have a crowned watershed finish.

Concrete shall be proportioned to provide at least 2,500 psi strength at 28 days. Materials, methods of proportioning, mixing, transporting and placing shall conform to Section 03300. After the concrete has set, accessories shall be installed; chain link fabric shall be fastened to end posts with stretcher bars and clamps and to line posts and top rail with wire or bands at approximately 14-inch

centers and 24-inch centers, respectively. Three lines of barbed wire shall be installed on the extension arms and drawn taut and secured at each bracket.

3.3 GATE INSTALLATION

Install gateposts in accordance with manufacturer's instructions.

Gate posts shall be diagonally braced to adjacent line posts to ensure stability. Gates shall be hung and all hardware adjusted so that gates operate satisfactorily from open or closed position.

Concrete set gateposts: Drill holes in firm, undisturbed or compacted soil. Holes shall have diameter four times greater than outside dimension of post, and depths approximately 6-inches deeper than post bottom. Excavate deeper as required for adequate support in soft and loose soils, and for posts with heavy lateral loads. Set post bottom 36 inches below surface when in firm, undisturbed soil. Place concrete around posts in a continuous pour, tamp for consolidation. Trowel finish around post and slope to direct water away from posts. Check each post for vertical and top alignment, and maintain in position during placement and finishing operations.

Install gates plumb, level, and secure for full opening without interference.

Attach hardware by means which will prevent unauthorized removal. Adjust hardware for smooth operation.

*****END OF SECTION*****

SECTION 02900

LANDSCAPING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the installation of all landscaping work as shown on the Plans and as specified herein. Landscaping activities shall include work both at the project location as well as any residential properties that are affected by construction activities.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement & Payment
01300	Submittals
02230	Clearing & Grubbing
02300	Earthwork

1.3 SUBMITTALS

A. SEED MIX

See Section 2.4 of this Specification.

1.4 QUALITY ASSURANCE

A. SEED

Conform to the minimum standards for “certified” grade seed.

Furnished in standard container on which the following information is shown: seed name, lot number, net weight, percentage of purity, germination, weed seed and inert material.

Furnish to the Owner duplicate copies of a statement signed by the vendor, certifying that each lot of seed has been tested by a recognized seed testing laboratory within 6 months before the date of delivery on the Project.

Seed that is wet, moldy, or otherwise damaged in transit or storage will not be accepted.

PART 2 MATERIALS

2.1 TOPSOIL

The topsoil shall consist of 67 percent sandy loam and 33 percent composted organic material by volume.

The soil shall meet the following requirements:

Soil shall be sandy loam or loamy sand consisting largely of sand, but with enough silt and clay present to give it a small amount of stability. Individual sand grains can be seen and felt readily. On squeezing in the hand when dry, it shall fall apart when the pressure is released; on squeezing when moist, it shall form a cast that does not only hold its shape when the pressure is released, but shall withstand careful handling without breaking.

The mixed soil shall meet the following gradation:

<u>Screen Size</u>	<u>Percent Passing</u>
1/2 inch	100
1/4 inch	95 – 100
#10	85 – 95
#30	60 – 75
#60	50 – 60
#100	20 – 30
#200	5 – 15

Shall have a pH range of 5.5 to 7.5. Soils indicated having a pH below 5.5 shall be treated with dolomitic limestone as necessary to attain this pH range. Soils having a pH greater than 7.5 shall be treated with sulfur as necessary to attain this pH range. The pH shall be determined by soil test.

Organic material shall consist of composted yard debris or organic waste material composted for a minimum of 3 months. Compost shall consist of 100 percent recycled content. In addition, the organic material shall have the following physical characteristics:

1. Shall pass a standard cress test for seed germination (90 percent germination compared to standard).
2. Shall have a pH from 5.5 to 7.5.
3. Shall have a maximum electrical conductivity of 3.0 ohms/cm.
4. Shall have a maximum carbon to nitrogen ratio of 40:1.

5. Shall be certified by the “Process to Further Reduce Pathogens” (PFRP) guideline for hot composting as established by the United States Environmental Protection Agency.

Submit a certified laboratory analysis from an accredited soils testing laboratory indicating the Material source and compliance with all planting soil Specifications to the Engineer for approval before delivery to the Project Site. The analysis shall be with a sample size of no less than 1 pound.

2.2 COMPOST

Composted material shall be derived from a Type 1 feedstock and produced by a facility in compliance with WAC 173-350-220. The compost shall meet Grade AA Compost as defined by Ecology’s Interim Guidelines for Compost Quality (Publication #94-38, Revised November 1994). Compost material shall have 100 percent passing a 1/2-inch screen. The carbon to nitrogen ratio (C:N) of the compost shall be in the range of 20:1 to 35:1. Organic matter of the composted material shall be between 4 percent and 10 percent, and the moisture content shall be between 35 percent to 50 percent as determined by ASTM D 2974. The pH of the compost shall be within the range of 5.5 to 7.0 as determined by ASTM D 2976. The maximum electrical conductivity of composted material shall be 6 ohms/cm. Decomposed Organic Compost shall be mature as determined by US Composting Council stability test ratings referred to in the Ch 173-350 WAC. The product shall be tested within 6 months of proposed use.

2.3 SEEDING, FERTILIZING, AND MULCHING

All areas that have been cleared and grubbed, graded, and where restoration is required, shall receive seeding, fertilizing and mulching. These areas shall be leveled, acceptable to the Owner, existing topsoil broken up to a depth of 6 inches and hydroseeded. Graded areas shall receive 6 inches of Class A topsoil prior to hydroseeding. Native materials selected by the Engineer from material excavated for foundations and stockpiled on site shall be used for topsoil.

For those areas in which hydroseeding would be difficult, the Contractor may request approval from the Owner to hand-apply the hydroseeding mix. Approval shall be granted for hand-application only after reviewing and approving the procedure that the Contractor recommends.

Seeding, fertilizing and mulching shall be installed using an approved-type hydroseeder.

The seed mixture shall have the following composition, proportion and quality:

Alternative 1 Seed Mixture Typical Western Washington

Kind and Variety of Seed in Mixture	Percent By Weight	Minimum Percent of Pure Seed	Minimum Percent of Germination
Colonial Bent Grass (Highland or Astoria)	10%	9.8%	85%
Creeping Red Fescus (Illahee Rainier or Pennlawn)	40%	39.2%	90%
Perennial Rye Grass	30%	29.4%	90%
White Clover (Pre-inoculated)	20%	19.6%	90%
Maximum Percentage of Weed Seed	1.0%		
Maximum Inert and Other Crops	1.0%		

The seed shall be applied at a minimum rate of 120 pounds per acre.

A commercial fertilizer of the following formulation shall be furnished as specified, and all fertilizer shall be premixed prior to use on the job. The fertilizer shall be applied at the rate of 500 lbs. per acre.

Nitrogen (Inorganic) as N ₂	Nitrogen (Organic) Ureaformaldehyde	Phosphorous as P ₂ O ₅	as K ₂ O	Potassium lbs/Acre
10%	38%	20%	20%	500

Wood cellulose fiber mulch shall be applied at the rate of 2,000 pounds per acre.

PART 3 EXECUTION

3.1 PRODUCT DELIVERY

A. DELIVERY

Deliver fertilizer and soil additives to the site in original unopened containers bearing manufacturer's guaranteed chemical analysis, weight, manufacturer's name, trademark, and conformance with state law.

3.2 SEED INSTALLATION

Seeding, fertilizing and mulching shall be installed in conformance with Sections 8-01 and 9-14 of the WSDOT Standard Specifications.

The seed materials will be applied in two applications. The first application shall consist of seed and a non-toxic tracer. The second application shall consist of a

homogenous mixture of fertilizer and wood cellulose fiber mulch, and shall be uniformly applied over the seed within 48 hours of the seed application unless otherwise directed by the Owner.

When weather conditions are not conducive to satisfactory results from seeding operations, the Owner may order the work suspended and it shall be resumed only when the desired results are likely to be obtained.

Inspection is required for each area when seeding and fertilizing is complete, and again after mulching is complete.

Areas not receiving a uniform application of seeding at the specified rate as determined by the Engineer shall be reseeded at the Contractor's expense prior to mulching or payment.

3.3 SEEDED AREA SOIL PREPARATION

Verify that planting bed grades are in accordance with those indicated on the Plans before proceeding with work. Verify that soil conditions are satisfactory for soil preparation work.

Prepare soil no closer than 3 feet from existing tree trunks up to 6 inches in diameter; no closer than 4 feet from existing tree trunks up to 12 inches in diameter; no closer than 6 feet from existing tree trunks larger than 12 inches in diameter.

Loosen compacted soils to a depth of 12 inches. Rake and remove all material larger than 1-1/2 inches in diameter.

Place 2 inches of compost over existing soil, mix and till to a depth of 6 inches. This material shall be suitable topsoil from the site or imported material.

3.4 WEED CONTROL

The Contractor shall use extreme care to ensure chemicals remain within the designated areas. The use of chemical herbicides shall require the use of anti-drift and activating agents and a spray pattern indicator, unless otherwise allowed by the Owner.

All applications of post-emergent herbicides shall be made while green and growing tissue is present. Should unwanted vegetation reach the seed stage in violation of these Specifications, the Contractor shall physically remove and bag the seed heads. All physically removed vegetation and seed heads shall be disposed of offsite at no cost to the Owner.

The Contractor shall assume all responsibility for rendering any area unsatisfactory for planting by reason of chemical application. The Contractor shall replace, repair and pay for all damages caused by his/her negligence to the satisfaction of the Owner prior to final payment.

3.5 PEST CONTROL

The Contractor shall use extreme care to ensure chemicals remain within the designated areas. The use of spray chemical pesticides shall require the use of anti-drift and activating agents and a spray pattern indicator, unless otherwise allowed by the Owner.

The Contractor shall assume all responsibility for rendering any area unsatisfactory for planting by reason of chemical application. The Contractor shall replace, repair and pay for all damages caused by his/her negligence to the satisfaction of the Owner prior to final payment.

3.6 CONSTRUCTION ACCEPTANCE

Construction acceptance shall be subject to well-established seeded areas that fulfill the requirement of the approved Plans. The Contractor shall protect and care for all plantings until fully established and healthy. Care shall include equipment and labor necessary to provide sufficient and continuous watering of all seeded areas until final acceptance.

Final Acceptance of all landscaping work described in this Specification, with the exclusion of possible replacements of plant materials under the Guarantee, shall be made by the Owner to determine 100 percent completion of the Contract work. This review shall be made upon written request to the Owner no less than 48 hours prior to the anticipated date of inspection.

***** END OF SECTION *****

DIVISION 3

CONCRETE

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes reinforcement and associated items for all concrete, including, but not necessarily limited to: reinforcing steel bars, wire fabric, and accessories for cast-in-place concrete.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
01310	Project Meetings
01400	Quality Control
03300	Cast-In-Place Concrete
04200	Masonry

1.3 REFERENCES

This Section references the latest revisions of the following documents:

<u>Reference</u>	<u>Title</u>
ACI 301	Structural Concrete for Buildings
ACI 318	Building Code Requirements for Structural Concrete
ACI SP-66	American Concrete Institute - Detailing Manual
ANSI/ASTM A82	Cold Drawn Steel Wire for Concrete Reinforcement
ANSI/ASTM A185	Welded Steel Wire Fabric for Concrete Reinforcement
ANSI/AWS D1.4	Structural Welding Code for Reinforcing Steel
ASTM A615	Deformed and Plain Billet Steel Bars for Concrete Reinforcement

1.4 SUBMITTALS

Submit in accordance with provisions of Section 01300.

A. SHOP DRAWINGS

Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and welded wire fabric, bending and cutting schedules, and supporting and spacing devices.

B. MANUFACTURER'S CERTIFICATE

Certify that reinforcing bar and welded wire fabric meet or exceed specified requirements.

Submit certified copies of mill test reports of reinforcement materials analysis.

1.5 QUALITY ASSURANCE

Perform Work in accordance with ACI 301.

1.6 COORDINATION

Coordinate with placement of formwork, formed openings, and other Work.

PART 2 PRODUCTS

2.1 REINFORCEMENT

A. REINFORCING STEEL

ASTM A615, deformed bars: Grade 40 for #3 bars and smaller, Grade 60 for #4 bars and larger, unless noted otherwise on the Plans.

B. WELDED STEEL WIRE FABRIC

ASTM A185 Plain Type; in flat sheets; plain.

2.2 ACCESSORY MATERIALS

A. TIE WIRE

Minimum 16-gauge annealed type.

B. CHAIRS, BOLSTERS, BAR SUPPORTS, SPACERS

Sized and shaped for strength and support of reinforcement during concrete placement conditions including load-bearing pad on bottom where required to prevent vapor barrier puncture.

**C. SPECIAL CHAIRS, BOLSTERS, BAR SUPPORTS, SPACERS
ADJACENT TO WEATHER EXPOSED CONCRETE SURFACES**

Plastic-coated steel type; size and shape as required.

D. MECHANICAL BAR SPLICES

Comply with ACI 318 requirement of minimum tensile strength of 125 percent of specified yield for reinforcement.

Subject to compliance with the requirements and approval of the Engineer, products, which may be incorporated into the work include, but are not limited to, the following:

BAR-LOCK (MBT) Coupler Systems
“ERICO” REBAR SPLICING

E. ADHESIVE ANCHORS

Injection adhesive system shall consist of a dual-cylinder adhesive refill pack, a mixing nozzle, and dispenser. The adhesive shall be formulated to include resin and hardeners.

1. Subject to compliance with the requirements, products which may be incorporated in the work include, but are not limited to, the following:

- a. HIT RE 500 Injection Adhesive Anchor, Hilti, Inc.
- b. SET-XP, Simpson Strong Tie, Inc.
- c. PE1000+, Powers Fasteners, Inc.

2.3 FABRICATION

Fabricate concrete reinforcing in accordance with ACI SP-66. Obtain written approval from the Engineer prior to welding reinforcing steel. Weld reinforcement in accordance with ANSI/AWS D1.4.

PART 3 EXECUTION

3.1 PLACEMENT

Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars" for details and methods of reinforcement placement and supports, and as herein specified. Avoiding cutting or puncturing vapor barrier during reinforcement placement and concreting operations.

Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal/plastic chairs, runners, bolsters, spacers, and hangers, as required.

Install reinforcing bars with clearance indicated on the Plans. Provide laps as shown and stagger locations to minimize the concentration of multiple reinforcing at joints. Bar lap splicing shall have full contact. Where full contact cannot be achieved, the maximum space between the spliced bars shall not exceed 2 inches. Unless noted otherwise on the Plans, provide two #5 minimum trim bars around all openings and penetrations. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with tie wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

***** END OF SECTION *****

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes schedules, notes, and details for the construction of cast-in-place concrete structures, landings, equipment piers, housekeeping pads and slabs on grade.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
01310	Project Meetings
01400	Quality Control
03200	Concrete Reinforcement
Division 7	Thermal and Moisture Protection

1.3 REFERENCES

This Section references the latest revisions of the following documents:

<u>Reference</u>	<u>Title</u>
ACI 117	Specifications for Tolerances for Concrete Construction and Materials and Commentary
ACI 212.3	Chemical Admixtures for Concrete
ACI 301	Specifications for Structural Concrete
ACI 304	Guide for Measuring, Mixing, Transporting, and Placing Concrete
ACI 305	Hot Weather Concreting
ACI 306	Cold Weather Concreting
ACI 309	Guide for Consolidation of Concrete
ACI 318	Building Code Requirements for Structural Concrete and Commentary
ACI 350	Code Requirements for Environmental Engineering Concrete Structures and Commentary
ACI 347	Guide to Formwork for Concrete
ACI 350.1	Tightness Testing of Reinforced Engineering Concrete Structures and Commentary
ASTM C31	Making and Curing Concrete Test Specimens in the Field
ASTM C33	Concrete Aggregates
ASTM C39	Compressive Strength of Cylindrical Concrete Specimens

ASTM C42	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C94	Ready-Mixed Concrete
ASTM C131	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C143	Slump of Hydraulic Cement Concrete
ASTM C150	Portland Cement
ASTM C172	Sampling Freshly Mixed Concrete
ASTM C173	Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C231	Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260	Air-Entraining Admixtures for Concrete
ASTM C309	Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C494	Chemical Admixtures for Concrete
ASTM C535	Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C618	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C881	Epoxy-Resin-Base Bonding Systems for Concrete

1.4 SUBMITTALS

Submittals shall be in accordance with Section 01300.

A. GENERAL

The submittal for each included concrete mix shall include, as a complete package, the following as defined below:

1. Concrete Mix Design
2. Certified Test Results
3. Sieve Analysis
4. Product Data

An incomplete concrete mix submittal package may render a rejection of the mix or could delay the review process.

B. CONCRETE MIX DESIGN

Submit mix design for the proposed mix to be used on the Project, indicating components, and proportions by weight, including any admixtures. Mix design shall state chloride content. Mix designs to be provided are:

1. Unspecified Concrete
2. Lean Concrete
3. Cement Grout

C. CERTIFIED TEST RESULTS

Submit laboratory test results indicating compressive strength of concrete in compliance with requirements specified herein and in accordance with ACI 301.

D. SIEVE ANALYSIS

Submit sieve analysis for proposed coarse and fine aggregates indicating components, source, gradation, and WSDOT aggregate source approval report, including WSDOT Aggregate Source ID.

E. PRODUCT DATA

Provide product data on all proposed admixtures, accessories, and embedded items to be used on the Project, including, but not limited to:

1. Cement; source and type
2. Air Entraining Agent
3. Water Reducing Admixtures
4. Pozzolans
5. Bonding Agents
6. Curing Compounds/Floor Hardeners
7. Non-Shrink Grout; Non-metallic and Metallic
8. Waterstops

9. Plastic Joint Formers

10. Vapor Barriers

11. Stair Nosings

For admixtures other than those proposed for air entrainment, submit a letter from the manufacturer describing the benefits of its use for the project and effect of its use on the properties of the concrete. Product data shall expressly state admixtures are chloride free, or the manufacturer shall submit a letter certification stating the same.

F. MATERIAL DELIVERY TICKETS

Provide copies of all concrete and grout material delivery tickets for the Project to the Engineer.

1.5 QUALITY ASSURANCE

Perform work in accordance with ACI 301. Acquire cement and aggregates from same source for all work performed on the Project. Conform to ACI 305 when concreting during hot weather. Conform to ACI 306 when concreting during cold weather. Provide or coordinate field and laboratory testing as described later in this Section and under provisions of Section 01400.

1.6 COORDINATION

Coordinate work in accordance with provisions of Section 01310. Coordinate the placement of embedded items with erection of concrete formwork and placement of form accessories.

PART 2 PRODUCTS

2.1 FORM MATERIALS

A. FORMS FOR EXPOSED FINISH CONCRETE

Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on the Plans.

B. FORMS FOR UNEXPOSED FINISH CONCRETE

Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.

C. FORMS FOR CYLINDRICAL COLUMNS AND SUPPORTS

Metal, fiberglass reinforced plastic, or paper or fiber tubes. Construct paper or fiber tubes of laminated plies using water-resistant adhesive with wax-impregnated exterior for weather and moisture protection. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation.

D. FORM COATINGS

Provide commercial formulation form-coating compounds that will not bond with, stain, or adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

E. FORM TIES

Factory-fabricated, adjustable-length, removable or snapoff metal form ties, designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units, which will leave no metal closer than 1-1/2 inches to surface. Unless noted otherwise on Plans, provide ties with plastic cone devices which, when removed, will leave holes not larger than 1-inch diameter in concrete surface.

2.2 CONCRETE MATERIALS

A. CEMENT

ASTM C150, Type II – Moderate or Type I - II. Use one brand of cement throughout the project, unless otherwise approved by the Engineer. Provide low alkali cement where Alkali-Silica Reaction (ASR) mitigation measures are required by WSDOT Aggregate Source Approval.

B. FINE AND COARSE AGGREGATES

Comply with ASTM C33. Provide aggregates from a single source. Coarse aggregate shall be size designation 467 (Nominal size 1-1/2 inch to No. 4 sieve) for all liquid containing structures, and size designation 67 (Nominal size 3/4-inch to No. 4 sieve) for all other concrete. Aggregates shall show a loss of weight not exceeding 35 percent after 500 revolutions in a Los Angeles wear machine, when tested in accordance with ASTM

C131 or ASTM C535. Aggregates shall be from a WSDOT approved source.

Coarse aggregate will be the largest nominal size permitted by ACI 301/318.

C. WATER

Clean, potable, and not detrimental to concrete, in compliance with ASTM C94.

2.3 ADMIXTURES

Except for air entrainment, use of all other admixtures used shall be subject to approval of the Engineer and at no additional cost to the Owner. Only admixtures expressly stated by the manufacturer as being chloride-free shall be used. Subject to compliance with requirements, products, which may be incorporated into the work include, but are not limited to, the following:

A. AIR ENTRAINMENT

ASTM C260 certified by manufacturer to be compatible with other proposed admixtures.

Master Builders MB AE 90 or MICRO-AIR
Sika AER
W.R. Grace Daravair or Darex Series

B. WATER REDUCING ADMIXTURE

ASTM C494 Type A.

Master Builders PolyHeed
Sika Plastocrete 161
W.R. Grace WRDA Series

C. ACCELERATING ADMIXTURE

ASTM C494 Type C.

Master Builders Pozzoloth NC534
Sika Plastocrete 161 FL
W.R. Grace Polarset or DCI

D. WATER REDUCING, RETARDING ADMIXTURE

ASTM C494, Type D.

Master Builders Pozzolith 100XR
Sika Plastiment
W.R. Grace Daratard Series

E. WATER REDUCING, ACCELERATING ADMIXTURE

ASTM C494, Type E.

Euclid Chemical Co. Accelguard 80
Master Builders Pozzutec 20
W.R. Grace Daraccel

F. HIGH RANGE WATER REDUCER (HRWR)

ASTM C494, Type F.

Master Builders Rheobuild 1000/3000 FC
Sika Sikament 10 ESL
W.R. Grace ADVA 100

G. HIGH RANGE WATER REDUCER AND RETARDER

ASTM C494, Type G.

Master Builders Pozzolith 440N
W.R. Grace Daracem-100

H. POZZOLAN

ASTM C618 - CLASS F, with a CaO maximum content of 10 percent.

2.4 ACCESSORIES

A. BONDING AGENT

ASTM C881, Type I and II, Grade 2, Class C, Epoxy Resin. Subject to Contract requirements, provide one of the following or equal:

Sika Armatec 110
Conspec SpecBond 100
W.R. Meadows Sealtight Rezi Weld 1000

B. CURING COMPOUND/CHEMICAL FLOOR HARDENER

ASTM C309, Type I, Class A and B. Subject to Contract requirements, provide one of the following or equal:

W.R. Meadows Sealtight 1100-Clear
Conspec RX cure
Chemrex, Inc. Masterkure
Burke Spartan-Cote WB

C. GENERAL PURPOSE NON-SHRINK NON-METALLIC GROUT

Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi (17 Mpa) in 48 hours and 7,000 psi (48 Mpa) in 28 days. Subject to Contract requirements, provide one of the following or equal:

Sika SikaGrout 212
Conspec 100 Non Metallic
Chemrex, Inc. Masterflow 928 Grout
W.R. Meadows Sealtight 588

D. WATERSTOPS

Provide waterstop of type and size at construction joints and other joints as indicated on the Plans.

1. PVC (Polyvinyl Chloride)

Serrated (ribbed), 3/8 of an inch minimum thickness for 6 inches and larger and 3/16 of an inch minimum thickness for 4 inches. Comply with Corps of Engineers CRD-C-572. No reclaimed PVC will be allowed in waterstop.

Subject to compliance with requirements, manufacturers offering products, which may be incorporated in the work, include, but are not limited to, the following:

Greenstreak
Vinylex Corporation
W.R. Meadows

2. Cold Joint Waterstop

Install where shown on the Plans or at locations approved by the Engineer. Cold joint waterstop shall be certified by the manufacturer to be compatible for use in wastewater (sewage) containment structures. Unless otherwise shown in the Plans, size shall be 1-inch thick and 1-inch wide.

Subject to compliance with requirements, manufacturers offering products, which may be incorporated in the work, include, but are not limited to, the following:

Hydrotite, Greenstreak

E. PLASTIC JOINT FORMER

Provide and install, per manufacturer's recommendations, where shown on the Plans or at locations approved by the Engineer. Subject to compliance with requirements, manufacturers offering products, which may be incorporated in the work, include, but are not limited to, the following:

Greenstreak
Vinylex Corporation
W.R. Meadows

F. VAPOR BARRIER

Six-mil fabric reinforced plastic film.

2.5 CONCRETE MIX

A. GENERAL

Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method is used, use an independent testing facility acceptable to the Engineer for preparing and reporting proposed mix designs. The testing facility shall not be the same as that used for field quality control testing.

The maximum water soluble chloride ion content, expressed as a percent of the cement, contributed from all ingredients of the concrete mix, including water, aggregates, cementitious materials, and admixtures, shall not exceed 0.10 percent. Pozzolans may be counted as part of the total cementitious material in the concrete mix design. The cementitious

material is the “minimum cement content” specified in the mix design for each type of concrete. When pozzolans are used as part of this “cement content,” the minimum content shall be 15 percent by weight of the total cementitious materials (Portland cement and pozzolans) and not more than 20 percent.

Where ASR mitigation measures are required by WSDOT, provide a minimum of 15 percent pozzolan included in the cementitious material in the design mix.

B. MIX DESIGNS

Provide normal weight concrete with the following properties, unless noted otherwise on the Plans.

1. Unspecified Concrete

Structural concrete of general use in structures, sidewalks, and where no specific class of concrete is designated.

Minimum compressive strength @ 28 days:	4,000 psi
Minimum cement content:	6 sacks per cubic yard
Maximum water cement ratio by weight:	0.45
Nominal coarse aggregate size:	1-1/2" to No. 4 (size designation 467)

2. Lean Concrete

Concrete for pipe thrust blocks or for use as noted as “Concrete Fill” on the Plans.

Minimum compressive strength @ 28 days:	2,500 psi
Minimum cement content:	5 sacks per cubic yard

3. Cement Grout

Material for filling guard posts, grouting of clarifier bottoms or for other uses as shown on the Plans. Cement grout shall be sand and cement only and shall not contain coarse aggregate.

Minimum compressive strength @ 28 days:	2,500 psi
Minimum cement content:	6.5 sacks per cubic yard
Maximum water cement ratio by weight:	0.54

C. ADMIXTURES

1. Air Entrainment

Use air-entraining admixture complying with ASTM C260 in all exterior exposed concrete. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement in accordance with ASTM C173 or C231 having total air content with a tolerance of plus or minus 1 percent within the following limits:

5.5 percent for 1.5 inch max. coarse aggregate size

6.0 percent for 1.0 inch max. coarse aggregate size

7.0 percent 0.50 inch or less max. coarse aggregate size

2. Other Admixtures

Use of all other admixtures shall be subject to the approval of the Engineer, and shall be in accordance with ACI 212.3 and Manufacturer's recommendations. Only admixtures stated by the manufacturer to be chloride free shall be used.

D. SLUMP LIMITS

Proportion and design mixes to result in concrete slump (1 inch \pm of the maximum) at the point of placement in accordance with ASTM C143 as follows:

Ramps, slabs, and sloping surfaces: 3 inches.

Reinforced foundation systems: 3 inches.

Other concrete: 4 inches.

Concrete containing HRWR admixture (super-plasticizer): Not more than 8 inches after addition of HRWR to site-verified 2- to 3-inch slump concrete.

E. CONCRETE MIXING

Comply with requirements of ASTM C94, and as herein specified.

During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than that specified in ASTM C94 may be required.

PART 3 EXECUTION

3.1 GENERAL

Coordinate the installation of joint materials and vapor barriers with placement of forms and reinforcing steel.

3.2 FORMS

Design, erect, support, brace, and maintain formwork to support vertical and lateral, static, and dynamic loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances complying with ACI 347.

Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials.

Construct forms to sizes, shapes, lines, and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the work. Use selected materials to obtain required finishes. Solidly butt joints and provide back up at all joints to prevent leakage of cement paste.

Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast-in-place concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Provide Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

Chamfer all exposed corners and edges and other areas shown on the Plans, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings,

recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

3.3 JOINTS AND WATERSTOPS

A. CONSTRUCTION JOINTS

Locate and install construction joints where indicated, or locate so as not to impair strength and appearance of the structure, as acceptable to the Engineer. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints, except as otherwise shown on the Plans.

B. WATERSTOPS

Provide waterstops in construction joints of all water containment structures and where shown on the Plans. Install waterstops to form continuous diaphragm in each joint in accordance with manufacturer's recommendations. Make provisions to support and protect exposed waterstops during progress of work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions and recommendations. All waterstops shall be tied into place using hog rings and/or tie wire to keep the waterstop from moving during placement of concrete. Provide manufacturer's written warranty for all waterstop installations.

C. ISOLATION JOINTS IN SLABS-ON-GRADE

Unless otherwise noted, construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as shown on the Plans.

Joint filler and sealant materials are specified in Division 7.

D. SLAB (CONTROL) JOINTS

Construct joints in slabs-on-grade as shown on the Plans. Use saw cuts 1/8 of an inch wide x 1/4 of the slab depth or inserts 1/4-inch wide x 1/4 of the slab depth.

E. PREMOLDED (CONTROL) JOINTS

Insert premolded plastic, hardboard or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round

on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.

F. EDGE FORMS AND SCREED STRIPS FOR SLABS

Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

3.4 INSTALLATION OF EMBEDDED ITEMS:

A. GENERAL

Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use installation drawings, diagrams, instructions, and directions provided by suppliers of items to be embedded.

B. CLEANING AND TIGHTENING

Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Retighten forms and bracing after concrete placement as required to eliminate mortar leaks and maintain proper alignment.

C. REGLETS

Install reglets to receive top edge of foundation sheet waterproofing, and to receive thru-wall flashing as shown at lintels, relieving angles, and other conditions.

3.5 VAPOR BARRIER INSTALLATION

Following leveling and tamping of granular base material for slabs on grade, place vapor barrier sheeting with longest dimension parallel with direction of concrete placement.

Lap joints a minimum of 6 inches and seal with appropriate approved tape. After placement of vapor barrier, cover with sand material and compact to depth as shown on the Plans.

3.6 PLACING REINFORCEMENT

See Section 03200.

3.7 PREPARATION OF FORM SURFACES

Clean reused forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.

Thin form coating compounds only with thinning agent of type, amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.8 PREPARATION OF EXISTING CONCRETE SURFACES

The Contractor shall bush hammer all existing concrete surfaces that are to have new concrete cast against them. Apply epoxy bonding agent prior to placing concrete.

3.9 CONCRETE PLACEMENT

A. GENERAL

Comply with ACI 304 and as herein specified.

Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Apply temporary protective covering to lower 2 feet of finished walls adjacent to poured floor slabs and similar conditions, and guard against spattering during concrete placement.

B. PLACING CONCRETE IN FORMS

Deposit concrete in forms in horizontal layers not deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.

Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

C. PLACING CONCRETE SLABS

Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners. Bring slab surfaces to correct level with straightedge and strikeoff. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations. Maintain reinforcing in proper position during concrete placement operations.

D. COLD WEATHER PLACING

Protect concrete work from physical damage or reduced strength, which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.

When air temperature has fallen to or is expected to fall below 40 degrees F (4 degrees C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees F (10 degrees C), and not more than 80 degrees F (27 degrees C) at point of placement.

Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.

E. HOT WEATHER PLACING

When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees F (32 degrees C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is at Contractor's option.

Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete. Fog spray forms, reinforcing steel, and subgrade just before concrete is placed. Upon approval, water-reducing retarding admixture (Type D) may be used when required by high temperatures, low humidity, or other adverse placing conditions.

3.10 FINISH OF FORMED SURFACES

Provide smooth form finish for all formed concrete surfaces exposed-to-view including all surfaces exposed to water or wastewater, or that are to be covered with a coating material applied directly to the concrete, or a covering material applied directly to concrete, such as veneer plaster, painting, or other similar type of system.

Provide smooth form finish for surfaces to be waterproofed or dampproofed. Surfaces must comply with recommendations of the manufacturer of the product being utilized.

Provide rough form finish for formed concrete surfaces not exposed-to-view in the finished work or by other construction, unless otherwise indicated.

A. SMOOTH FORM FINISH

This is to be the as-cast concrete surface obtained utilizing selected form facing material, arranged orderly and symmetrically with a minimum of seams, and as specified herein.

Repair and patch tie holes and defective areas, with all fins or other projections completely removed and smoothed, by one of the following methods:

1. Provide smooth rubbed finish to concrete surfaces after form removal. Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.

2. Provide grout “sacked” cleaned finish. The sacking grout shall be one part Portland cement to 1-1/2 parts fine sand by volume, and mixed with water to consistency of thick paint. Proprietary additives such as epoxy bonding agents or adhesives may be used at Contractor’s option. Blend standard Portland cement and white Portland cement, amounts to be determined by trial patches, so that final color of dry grout matches adjacent surfaces. Thoroughly wet concrete surfaces and apply grout to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep sacked surfaces damp by fog spray or other acceptable method so surfaces do not dry out.

B. ROUGH FORM FINISH

This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/8 of an inch in height rubbed down or chipped off. All “bug holes” exceeding 1/2 inch in diameter and exceeding 1/4-inch depth shall be repaired or filled in.

C. RELATED UNFORMED SURFACES

At tops of walls, horizontal offsets, and similar unformed surfaces occurring at adjacent formed surfaces, continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

D. TOLERANCES FOR FORMED SURFACES

1. Variations from the plumb:
 - a. In the lines and surfaces of columns, pier, walls and in arises In any 10 feet of length – 1/4 inch. Maximum for entire length – 1 inch
 - b. For exposed corner columns, control-joint grooves, and other conspicuous lines In any 20 feet of length – 1/4 inch. Maximum for entire length – 1/2 inch

2. Variations from level or from the grades indicated on the Plans:
 - a. In slab soffits, ceilings, beam soffits, and in arises, measured before removal of supporting shores

	In any 10 feet of length – 1/4 inch. In any bay or opening, or in any 20 feet of length – 3/8 of an inch. Maximum for entire length – 3/4 inch
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 - b. In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines

	In any bay or opening, or in any 20 feet of length – 1/4 inch. Maximum for entire length – 1/2 inch
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3. Variations in the linear building lines from the established position in plan view

	In 20 feet of length – 1/2 inch. Maximum for entire length – 1 inch
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4. Variations in distance between walls, columns and partitions

	In any 10 feet of distance – 1/4 inch. In any bay or opening – 1/2 inch. Maximum total variation – 1-inch.
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5. Variations in the sizes and locations of sleeves, floor openings and wall openings

	Minus – 1/4 inch Plus – 1/2 inch
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6. Variations in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls

	Minus – 1/4 inch Plus – 1/2 inch
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7. Variations in footings:
 - a. Variation from dimensions on Plans when formed or plus 3-inches when placed against unformed excavations

	Minus – 1/2 inch Plus – 2 inches
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- | | | |
|----|---|---|
| b. | Misplacement of eccentricity | 2 percent of the footing width in the direction of the misplacement, but not more than 2 inches |
| c. | Reduction in thickness of specified thickness | Minus – 5 percent |
8. Variations in steps:
- | | | |
|----|-----------------------|---|
| a. | In a flight of stairs | Riser – 1/8 of an inch
Tread – 1/4 inch |
| b. | In consecutive steps | Riser – 1/16 of an inch
Tread – 1/8 of an inch |

3.11 MONOLITHIC SLAB FINISHES:

A. SCRATCH FINISH

Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping, including grout finishes where indicated on plans, or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and as otherwise indicated. Slope surfaces uniformly to floor drains where required. After leveling, roughen surface before final set, with stiff brushes, brooms, or rakes.

B. FLOAT FINISH

Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated.

After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check and level surface plane. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

C. TROWEL FINISH

Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film finish coating system. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks and uniform in texture and appearance. Grind smooth surface defects that would telegraph up through applied floor covering system.

D. TROWEL AND FINE BROOM FINISH

Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.

E. NON-SLIP BROOM FINISH

Apply non-slip broom finish to exterior concrete platforms, landings, steps, and ramps, sidewalks and elsewhere as indicated. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Owner before application.

F. CHEMICAL-HARDENER FINISH

Apply chemical-hardener finish to interior exposed concrete floors and steps, unless noted otherwise. Apply liquid chemical-hardener after complete curing and drying of the concrete surface. Evenly apply each coat, and allow 24 hours for drying between coats. Apply proprietary chemical hardeners, in accordance with manufacturer's printed instructions. After final coat of chemical-hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

G. TOLERANCES FOR MONOLITHIC SLAB FINISHES

The flatness of the concrete shall be carefully controlled and the tolerances shall be measured by the straight edge system as specified in paragraph 4.5.7 of ACI 117, using a 10-foot straight edge, within 72 hours after floor slab installation and before shores and/or forms are removed. The listed tolerances shall be met at any and every location at which the straight edge can be placed.

Bullfloated 1/2 inch
Float Finish 3/16 inch
Trowel Finish 1/8 inch
Straightedges 5/16 inch

3.12 CONCRETE CURING AND PROTECTION

A. GENERAL

Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep concrete continuously wet for not less than 7 days. Begin final curing procedures immediately following initial curing and before concrete has dried out. Continue final curing for at least 7 days in accordance with ACI 301 curing methods. Avoid rapid drying of concrete at the end of final curing period.

B. CURING METHODS

Perform curing of concrete by use of curing and sealing compound, by moist curing, by moisture-retaining cover curing, or by combinations thereof, as herein specified.

Provide moisture curing by the following methods. Keep concrete surface continuously wet by covering with water, or provide continuous water-fog spray.

Covering concrete surface with absorptive cover, thoroughly saturating cover with water and keeping continuously thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4-inch lap over adjacent absorptive covers.

Provide moisture-cover curing as follows: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in wide as practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

Provide curing and sealing compound to exposed interior slabs and to exterior slabs, walls, sidewalks, and curbs, as follows:

Apply curing and sealing compound to concrete slabs and walls as soon as initial curing operations are complete or immediately after the forms have

been stripped (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Completely cover the concrete surfaces with curing and sealing compound. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair any damage during curing period.

Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring (such as ceramic or quarry tile, glue-down carpet), painting, and other coatings and finish materials, unless otherwise acceptable to the Engineer.

C. CURING FORMED SURFACES

Cure formed concrete surfaces, including undersides of beams, supported slabs, and other similar surfaces by moist curing with forms in place for full curing period and until forms are removed. When forms are removed, continue curing by methods specified above, as applicable.

D. CURING UNFORMED SURFACES

Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of an appropriate curing method.

Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture retaining cover.

3.13 SHORES AND SUPPORTS

A. GENERAL

Comply with ACI 347 for shoring, and as herein specified. Extend shoring from ground to roof for structures four stories or less, unless otherwise permitted. Remove shores and reshore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to safely support work without excessive stress or deflection.

Keep reshores in place a minimum of 15 days after placing upper tier, and longer if required, until all concrete has attained its required 28 day strength and heavy loads due to construction operations have been removed.

B. REMOVAL OF FORMS

Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 degrees F (10 degrees C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

Formwork supporting weight of concrete, such as beam soffits, joints, suspended slabs, and other structural elements, may not be removed in less than 14 days and until concrete has attained 70 percent of the design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens, representative of concrete location or members.

Form facing material may be removed 4 days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

3.14 REUSE OF FORMS

Clean and repair surfaces of forms to be reused in work. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable for exposed surfaces. Provide new form facing material. Apply new form coating compound as specified for new formwork prior to reuse of forms.

When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, unless approved by the Engineer and acceptable to the Owner.

3.15 MISCELLANEOUS CONCRETE ITEMS

A. FILLING-IN

Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work. Fill-in all form tie holes and other forming system holes with non-shrink grout.

B. CURBS

Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. BASE PLATE, EQUIPMENT BASES AND FOUNDATIONS

Provide machine and equipment bases (housekeeping pad/pier) and foundations, as shown on the Plans. Set anchor bolts for machines and equipment with template at correct elevations, complying with certified diagrams or templates of manufacturers furnishing machines and equipment.

Provide 4-inch-high, square or rectangular concrete pad around all conduits and small diameter pipes that penetrate through floor slabs.

Provide leveling grout under base plates and equipment frames using non-metallic, non-shrink grout. Minimum thickness for leveling grout shall be 1/2 inches unless noted otherwise on the Plans or specified by equipment manufacturer.

D. STAIR NOSINGS

Provide stair nosings at all exterior cast-in-place concrete stairs or steps. The stair nosings shall be installed in accordance with the manufacturer's written instructions.

3.16 CONCRETE SURFACE REPAIRS

A. PATCHING DEFECTIVE AREAS

Repair and patch defective areas immediately after removal of forms. Cut out honeycomb, rock pockets, voids or bugholes over 1/4 inch in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with specified bonding agent. For water and wastewater containment structures, utilize an epoxy resin bonding agent. Place patching mortar after bonding compound has dried.

For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous location to verify

mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

B. REPAIR OF FORMED SURFACES

Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of the Engineer. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, bug holes, honeycomb, rock pockets; fins and other discolorations that cannot be removed by cleaning. Flush out form tie holes and form bolt holes, fill with non-shrink grout, or precast concrete cone plugs or rubber plugs secured in place with bonding agent or epoxy adhesive.

Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. All repairs shall be approved by the Engineer. If defects cannot be repaired, the Contractor shall remove and replace the concrete.

C. REPAIR OF UNFORMED SURFACES

Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness using a template having required slope.

Repair finished unformed surfaces that contain defects, which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01 inches wide or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.

Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to the Engineer.

Repair defective areas, except random cracks and single holes not exceeding 1-inch diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3 inches of clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide

concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

Repair isolated random cracks and single holes not over 1 inch in diameter by dry-pack method. Groove top of cracks and cutout holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Mix dry-pack, consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry pack after bonding agent has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.

Perform structural repairs with prior approval of the Engineer for method and procedure, using specified epoxy adhesive and mortar. Repair methods not specified above may be used, subject to approval of the Engineer. If acceptable repairs cannot be made, the Contractor shall remove and replace the concrete at no cost to the Owner.

3.17 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. GENERAL

Sampling and testing for quality control during placement of concrete shall include the following:

1. Sampling Fresh Concrete

ASTM C172, except modified for slump to comply with ASTM C94.

2. Slump

ASTM C143: one test at point of discharge for each day's placement of each type of concrete; additional tests when concrete consistency seems to have changed.

3. Air Content

ASTM C173, volumetric method for lightweight or normal weight concrete; ASTM C231 pressure method for normal weight concrete; one for each day's placement of each type of air-entrained concrete.

4. Concrete Temperature

Test hourly when air temperature is 40 degrees F (4 degrees C) and below, and when 80 degrees F (27 degrees C) and above; and each time a set of compression test specimens is made.

5. Compression Test Specimen

ASTM C31; one set of four standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.

6. Compressive Strength Tests

ASTM C39; one set for each day's placement exceeding 5 cubic yards plus additional sets for each 50 cubic yards over and above the first 25 cubic yards of each concrete class placed in any 1 day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

When total quantity of a given class of concrete is less than 50 cubic yards, Engineer may waive strength test if, in their judgment, adequate evidence of satisfactory strength is provided.

When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.

Test results will be reported in writing to Engineer and Contractor within 24 hours after testing. FAX of test results is acceptable; however, mailing hard copies of test results is also required. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7 day tests and 28-day tests.

7. Nondestructive Testing

Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection of concrete.

8. Additional Tests

The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in a structure, as directed by the Owner. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed. Contractor shall pay for cost of such tests when unacceptable concrete is verified.

3.18 WATERTIGHTNESS

All water and wastewater holding tanks, basins and structures listed on the Structural Plans shall be tested for watertightness. Each tank, structure or basin shall be tested independently.

Watertightness tests shall be made after the concrete has obtained at least 90 percent of its required 28-day compressive strength, but in no case sooner than 20 days after placement. Watertightness shall conform to the requirements of ACI 350.1.

Leakage testing shall not be conducted during periods of time with measurable precipitation. Evaporation correction shall be made on the basis of an evaporation pan. Suitable evaporation pan shall be approved by Owner and shall be provided by Contractor.

Watertightness testing may follow backfill of the structure, at the Contractor's option. However, if the structure does not pass the test, re-excavation to locate leaks shall be required. All costs associated with location (re-excavation and backfilling) and repair of leaks shall be borne by the Contractor.

***** END OF SECTION *****

DIVISION 6

WOOD AND PLASTICS

SECTION 06100

ROUGH CARPENTRY

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section shows the extent of rough carpentry work on the Plans, including, but not limited to, the following: wood framing, timber posts and beams, rooftop equipment bases and support curbs, wood nailers and blocking, wood furring, fascia, soffits, and sheathing.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
01400	Quality Control
01310	Project Meetings

1.3 REFERENCES

This Section references the latest revisions of the following documents:

<u>Reference</u>	<u>Title</u>
ALSC PS 20	American Lumber Standards Committee (ALSC): American Softwood Lumber Standard
APA PRP-108	American Plywood Association (APA): Performance Standards and Qualification Policy for Structural-Use Panels
APA PS 1	American Plywood Association (APA): Product Standard for Construction and Industrial Plywood
ASTM A153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM D226	Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
AWC NDS	American Wood Council (AWC): National Design Specification for Wood Construction
AWC WFCM	American Wood Council (AWC): Wood Frame Construction Manual for one- and two-family dwellings
AWPA U1	American Wood-Preservers' Association (AWPA) Standard
WCLIB 17	West Coast Lumber Inspection Bureau (WCLIB): Standard Grading and Dressing Rules for Douglas Fir, Western Hemlock, Western Red Cedar, White Fir, Sitka Spruce Lumber

1.4 SUBMITTALS

Comply with provisions of Section 01300.

Submit a certificate of compliance from the supplier certifying that the materials provided meet or exceed specified requirements. Certificate shall itemize materials provided on the Project and refer to pertinent specifications.

1.5 DELIVERY, STORAGE AND HANDLING

Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber as well as plywood and other panels; provide for air circulation within and around stacks and underneath temporary coverings including polyethylene and similar materials. For lumber and plywood that is pressure treated with waterborne chemicals, provide a sticker between each course to provide air circulation.

PART 2 PRODUCTS

2.1 GENERAL

Lumber shall comply with ALSC PS 20 and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.

Each piece of lumber shall be factory marked with Grade Stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill that produced the product.

Nominal sizes are indicated on the Drawings, except as shown by detailed dimensions. Provide actual sizes as required by ALSC PS 20, with moisture content specified for each use.

Provide dressed lumber, S4S, unless otherwise indicated. Provide seasoned lumber with 19 percent maximum moisture content at time of dressing and shipment for sizes 2 inches or less in nominal thickness, unless otherwise indicated.

2.2 FRAMING LUMBER AND FASCIA BOARDS

Unless noted otherwise, provide Douglas Fir - Larch No. 2 or better, or Hem-Fir No. 1 or better.

2.3 BEAMS, STRINGER, POSTS AND TIMBERS

Unless noted otherwise on the Plans, provide Douglas Fir - Larch No. 1 or better. Glue Laminated Lumber: Douglas Fir, coast region. Bottom lamination shall be free of unsound knots or defects larger than 1/2-inch diameter. Provide industrial Appearance Grade. Each member shall bear the American Institute of Timber Construction (AITC) stamp. See Drawings for additional requirements.

2.4 TRIM BOARDS

Unless noted otherwise, provide No. 2 Common Boards or better complying with WPA rules. Where boards are exposed to finish work, provide 19 percent maximum moisture content. Exterior trim shall be cedar, Grade A or better.

2.5 MISCELLANEOUS LUMBER

Provide wood for support or attachment of other work including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, wood trim, stripping and similar members. Provide lumber of sizes indicated, worked into shapes shown or required. Provide Standard Grade Hem-Fir or better. Provide 19 percent maximum moisture content for lumber items not specified to receive wood preservative treatment.

2.6 SHEATHING

Provide APA-rated Exposure 1 unless noted otherwise, span rating and thickness as noted on the Plans.

Comply with PS 1 "Product Standard for Construction and Industrial Plywood" for plywood panels and for products not manufactured under PS 1 provisions, comply with APA PRP-108. Factory-mark each panel with APA trademark evidencing compliance with grade requirements.

2.7 PLYWOOD OTHER THAN SHEATHING

A. BACKING PANELS

For Plywood Backing Panels (or Boards) used for mounting electrical, telephone or communications system equipment, provide fire-retardant treated plywood panels with grade designation, APA C-D PLUGGED INT with exterior glue, in thickness indicated on the Drawings. If not otherwise indicated, provide minimum thickness of 15/32 of an inch.

B. SOFFITS

APA A-C Exterior, Exposure 1, thickness as indicated on the Plans, 1/2 inch minimum.

C. SIDING

APA-rated siding - 303; exterior thickness, texture and pattern as indicated on the Plans.

D. MARINE

APA, A-A exterior thickness as indicated on the Plans. HDO (High Density Overlay) faces are acceptable.

2.8 MISCELLANEOUS MATERIALS

A. FASTENERS AND ANCHORAGES

Provide size, type, material and finish as indicated and as recommended by applicable standards, complying with applicable federal specifications for nails, staples, screws, bolts, nuts, washers and anchoring devices. Provide metal hangers and framing anchors of the size and type recommended by the manufacturer for each use including recommended fasteners.

Where rough carpentry work is exposed to the weather, in ground contact, or in an area of high relative humidity, provide fasteners and anchorages with a hot-dip zinc coating per ASTM A153.

B. BUILDING PAPER

ASTM D226, Type I; asphalt saturated felt, non-perforated, 30-lb. type.

C. SILL SEALER GASKETS

Glass fiber resilient insulation fabricated in strip form for use as a sill sealer; 1-inch nominal thickness compressible to 1/32 of an inch; selected from manufacturer's standard width to suit width of sill members.

2.9 WOOD TREATMENT BY PRESSURE PROCESS

Where lumber or plywood is indicated as "P.T." or "Treated," or is specified herein to be treated, comply with applicable requirements of American Wood Preserver's Association (AWPA) Standard U1.

Pressure-treat above-ground items with waterborne preservatives to comply with AWWA Standard U1. After treatment, kiln dry lumber and plywood to a maximum moisture content, respectively, of 19 percent and 15 percent. Pressure treat items indicated on the Plans and all of the following: wood cants, nailer, curbs, top plates, equipment support bases, equipment curbs, plywood, blocking, stripping, and similar members utilized in connection with roofing, flashing, vapor barriers and waterproofing. All wood items including plywood used for or around roof penetrations shall be pressure treated.

PART 3 EXECUTION

3.1 GENERAL

Discard units of material with defects that could impair the quality of the work or with units too small to use in fabricating work with minimum joints or optimum joint arrangement. Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, and similar supports to allow attachment of other work.

Set carpentry work to required levels and lines, with members plumb and true to line and cut and fitted. Securely attach carpentry work to substrate by anchoring and fastening as shown and as required by recognized standards. Countersink nail heads on exposed carpentry work and fill holes.

Use common wire nails, except as otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; predrill as required.

3.2 WOOD NAILERS AND BLOCKING

Provide wherever shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated.

3.3 WOOD FURRING

Install plumb and level with closure strips at edges and openings. Shim with wood as required to obtain specified tolerance for finished work.

A. FURRING FOR PLYWOOD PANELING

Unless otherwise indicated, provide 1-inch x 3-inch furring at 2 feet on center, horizontally and vertically. Select furring for freedom from knots capable of producing bent over nails and resulting damage to paneling.

B. FURRING FOR GYPSUM DRYWALL

Unless otherwise indicated, provide 1-inch x 2-inch furring at 16-inch on center, vertically.

C. SUSPENDED FURRING

Provide size and spacing shown, including hangers and attachment devices. Level to a tolerance of 1/8 inch in 10 feet.

3.4 WOOD FRAMING, GENERAL

Provide framing members of sizes and on spacings shown, and frame openings as shown, or if not shown, comply with recommendations of the AWC WFCM. Do not splice structural members between supports. Anchor and nail as shown, and to comply with the AWC NDS.

Firestop concealed spaces of wood framed walls and partitions at each floor level and at the ceiling line of the top story. Where firestops are not automatically provided by the framing system used, use closely fitted wood blocks of nominal 2—inch-thick lumber of the same width as framing members.

3.5 STUD FRAMING

Provide stud framing of size and spacing indicated or, if not otherwise indicated, of the following sizes and spacings. Arrange studs so that wide face of stud is perpendicular to direction of wall or partition and narrow face is parallel. Provide single bottom plate and double top plates using 2-inch-thick members with widths equaling that of studs. Nail or anchor plates to supporting construction.

Unless noted otherwise, provide the following minimum framing:

1. For exterior walls provide 2" x 6" wood studs spaced 24-inches on center.
2. For interior partitions and walls provide 2" x 4" wood studs spaced 16-inches on center.

Construct corners and intersections with not less than three studs. Provide miscellaneous blocking and framing as shown and as required for support of facing materials, fixtures, specialty items and trim.

Provide continuous horizontal blocking row at mid-height of walls and partitions 8 feet high and greater, using 2-inch-thick members of same width of wall or partitions.

Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Set headers on edge and support on jamb studs.

For non-bearing partitions, provide double-jamb studs and headers not less than 4-inches deep for openings 3 feet or smaller in width, and not less than 6-inches deep for wider openings.

For load-bearing partitions, provide double-jamb studs for openings 6 feet or smaller in width, and triple-jamb studs for wider openings. Provide headers of depth shown.

Provide diagonal bracing in stud framing of exterior walls, except as otherwise indicated. Brace both walls at each external corner, full story height, at a 45-degree angle, using either a let-in 1" x 4" or 2" x 4" blocking or metal diagonal bracing. Omit bracing where plywood sheathing, siding and/or gypsum wallboard are indicated to be provided.

3.6 FLOOR AND ROOF JOIST FRAMING

Provide framing of sizes and spacings shown. Install with crown edge up and support ends of each member with not less than 3 inches of bearing on wood or metal, or masonry. Attach to wood bearing members by toe nailing or metal connectors; frame to wood supporting members with metal framing connectors. Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 4 feet. Do not notch in middle third of joists; limit notches to 1/6 depth of joist, 1/3 at ends. Do not bore holes larger than 1/3 depth of joist or locate closer than 2 inches from top or bottom. Provide solid blocking (2-inches thick by depth of joist) at ends of joists unless flush framed to supporting member.

At interior supports, for end bearing of 4 inches (nominal) or less, lap members framing from opposite sides of support (beams, girders or partitions) not less than 6 inches or securely tie opposing members together with strap tie. Provide solid blocking (2-inches thick by depth of joist) over supports.

Provide solid blocking between joists under jamb studs of partition walls and/or, provide double joists separated by solid blocking under partition walls.

Provide bridging between joists where nominal depth-to-thickness ratio exceeds 4, at intervals not to exceed 8 feet max. Use bevel-cut 1" x 4" or 2" x 4" wood bracing, double-crossed and nailed both ends to joists, or use solid wood bridging 2-inch thick by depth of joist, end-nailed to joist.

3.7 RAFTER AND CEILING JOIST FRAMING

A. CEILING JOISTS

Provide member size and spacing shown, and as previously specified for floor joist framing. Face nail to ends of parallel rafters.

Where principal ceiling joists are at right angle to rafters, frame as indicated with additional short joists from wall plate to first joist at spacing equal to principal ceiling joists; nail to ends of rafters and to top plate and to principal ceiling joists.

B. RAFTERS

Provide member size and spacing shown. Notch to fit exterior wall plates and toe nail or use special metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing (if any), and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.

At valleys, provide valley rafter of size shown, or if not shown, provide rafter twice as thick as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against valley rafter.

At hips, provide hip rafters of size shown, or if not shown, provide of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against hip rafters.

Provide collar beams (ties) as shown, or if not shown, provide 1" x 6" boards between every third pair of rafters. Locate below ridge member, 1/3 of distance to ceiling joists. Cut ends to fit slope and nail to rafters. Provide special framing as shown for eaves, overhangs, dormers, and similar conditions, if any.

3.8 TIMBER FRAMING

Provide wood beams and girders of the size and spacing shown. Install with crown edge up and provide not less than 4-inch bearing on supports. Provide continuous members unless shown; tie together over supports if not continuous.

Where beams or girders are framed into pockets of exterior concrete or masonry walls, provide 1/2-inch air space between sides and ends of wood members and supporting wall. Five-quarter cut members built into masonry construction.

Where built-up beams or girders of nominal 2-inch dimension lumber on edge are shown, fasten together with two rows of 16d nails spaced not less than 16-inches on center. Locate one row near top edge and other near bottom edge. Locate end joints in members over supports; for continuous members, stagger ends at quarter points between supports.

Provide wood posts of the sizes shown. Provide metal anchoring and attachment devices as shown.

3.9 INSTALLATION OF SHEATHING

A. GENERAL

Comply with applicable recommendations contained in the APA "Engineered Wood Construction Guide," for types of construction panels and applications indicated.

B. FASTENING METHODS

Fasten panels as indicated on the Plans. Include metal H clips between sheathing panels.

C. PLYWOOD BACKING PANELS

Nail to supports with minimum 10d at 6-inches on center edge nailing and 12-inches on center at intermediate framing.

***** END OF SECTION *****

DIVISION 7

THERMAL AND MOISTURE PROTECTION

SECTION 07210

BATT AND RIGID INSULATION

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the furnishing of all labor, materials, tools, and equipment required to install batt and rigid insulation, as indicated on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
01310	Project Meetings
01400	Quality Control
06100	Rough Carpentry

1.3 REFERENCES

This Section references the latest revisions of the following document:

<u>Reference</u>	<u>Title</u>
ASTM C578	Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C665	Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C1289	Standard Specification for Faced Rigid, Cellular Polyisocyanurate Thermal Insulation Board
ASTM C1320	Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.

1.4 PERFORMANCE REQUIREMENTS

Materials of this Section shall provide continuity of thermal and vapor and air barriers at building enclosure elements.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

Owens Corning, Johns Manville, CertainTeed, DOW, or approved equal.

2.2 MATERIALS

A. BATT INSULATION

Type III preformed, foil-faced, glass fiber batt or roll conforming to ASTM C665, to the thicknesses needed to meet the R-values shown on the Plans and as required by code.

B. RIGID ROOF INSULATION

Type 1, Class 1 rigid, closed cell Polyisocyanurate foam board insulation conforming to ASTM C1289, to the thicknesses needed to meet the R-values shown on the Plans and as required by code.

C. RIGID BELOW-GRADE INSULATION

Type IV rigid, closed cell extruded polystyrene foam board insulation conforming to ASTM C578, to the thicknesses needed to meet the R-values shown on the Plans and as required by code.

D. VAPOR BARRIER

Polyamide (nylon) vapor retarding, 2 mil, sheeting with a variable permeance ranging from 1 perm, or less, up to 10 perms, or greater, based on varying levels of ambient humidity; MemBrain Continuous Air Barrier & Smart Vapor Retarder by CertainTeed, or equal.

E. TAPE

Pressure sensitive, aluminum foil tape; Specialty Tape #425 by 3M, or equal.

F. INSULATION FASTENERS

Galvanized steel impale spindles and clips on 2-inch square flat bases with self adhering backing and length to suit insulation thickness. Include galvanized steel retaining washer(s) of not less than 1-1/2-inches in diameter capable of securely and rigidly fastening insulation in place; by Gemco, or equal.

G. BUILDING WRAP

Mechanically attached water-resistive, vapor permeable air barrier membrane system including primary sheet membrane, self-adhered flashing tape, and flashing primer (as needed). Entire system shall be provided by a single manufacturer. Tyvek CommercialWrap by DuPont, WrapShield IT by VaproShield, or equal.

H. INSULATION BAFFLES

Rigid polystyrene or PVC insulation baffles; Raft-R-Mate by Owens-Corning, AccuVent by Brentwood, or equal.

PART 3 EXECUTION

3.1 EXAMINATION

Verify site conditions before beginning installation. Verify that substrate and adjacent materials are ready to receive insulation, and free of all projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 GENERAL

Comply with insulation manufacturer's written instructions applicable to products and applications.

Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

Extend insulation to envelop entire area to be insulated with vapor barriers placed to face the interior (warm) side of the envelope. Fill all voids with insulation, fit tightly around all obstructions and tight to the exterior side of mechanical and electrical services within the plane of the insulation. Remove projections that interfere with placement. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-values.

All miscellaneous voids shall have insulation installed to prevent gaps in insulation using either fiberglass batt compacted to approximately 75 percent of normal maximum volume, or spray polyurethane foam applied according to the manufacturer's written instructions.

Prior to installation of finished surfaces, all vapor-retarder joints and ruptures shall be taped and sealed in each continuous area of insulation to ensure an airtight installation.

3.3 INSTALLATION BELOW GRADE

On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions.

Stagger all joints and butt all panels together for tight fit.

3.4 INSTALLATION IN FRAMED CONSTRUCTION

Install blanket insulation in all cavities formed by framing members. Use insulation widths and lengths that fully fill the cavities. If more than one length is required to fill cavities, provide lengths that will produce a snug fit between ends. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members, and lap all ends and side flanges of facings over framing members.

Prior to installation of attic insulation, install eave insulation baffles between roof framing members on the underside of roof sheathing in insulated attic spaces at vented eaves.

For metal-framed wall cavities, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs. For unfaced blankets, located vapor barrier joints over member faces and extend vapor barrier tight to the full perimeter of adjacent window and door frames, as well as other items interrupting the plane of membrane. Fully tape seal in place. Provide airspace at exterior plane of insulation for ventilation as recommended by manufacturer.

For wood-framed wall cavities, install blankets according to ASTM C1320 and as specified herein. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

***** END OF SECTION *****

SECTION 07410

METAL ROOF AND WALL PANELS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes, but is not necessarily limited to, furnishing and installing of all metal roofing, siding, metal fascia, gutters, downspouts, and accessories as indicated on the Plans and specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
01310	Project Meetings
01400	Quality Control
06100	Rough Capentry

1.3 SUBMITTALS

Submit in accordance with Section 01300 and as specified herein.

A. PRODUCT DATA

Submit manufacturer's technical product data, installation instructions, and recommendations for Metal Roof and Wall Panels used. Include data substantiating that materials comply with requirements.

B. SAMPLES

Prior to ordering products, submit manufacturer's standard color samples for Owner's selection.

C. SHOP DRAWINGS

Show panel layout, trim installation, and panel attachment. Include gutters and downspouts.

D. WARRANTY

1. Manufacturer's Product Warranty

Manufacturer's standard coating performance warranty, as available for specified installation and environmental conditions.

2. Contractor's Warranty

Warrant panels, flashings, sealants, fasteners, and accessories against defective materials and/or workmanship, to remain watertight and weatherproof with normal usage for 2 years following project substantial completion date.

1.4 QUALITY ASSURANCE

A. INSTALLER'S QUALIFICATIONS

Installation of panels and accessories by installers with a minimum of 5-years documented experience in metal panel projects of this nature.

B. MANUFACTURER'S QUALIFICATIONS

Manufacturer shall have a minimum of 10-years experience supplying metal roofing/siding to the region where the work is to be done.

C. REGULATORY AGENCY REQUIREMENTS

Comply with IBC and local Building Code requirements if more stringent than those specified.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

Protect panels against damage and discoloration. Handle panels with non-marring slings and do not bend panels. Store panels above ground, with one end elevated for drainage. Protect panels against standing water and condensation between adjacent surfaces. If panels become wet, immediately separate sheets, wipe dry and allow to air dry. Remove any strippable film prior to installation and do not allow too remain on panels in extreme cold, heat or in direct sunlight.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURER

AEP SPAN or approved equal. 2141 Milwaukee Way, Tacoma, Washington 98421, (253) 922-4963.

Panel Designation:

Roof: Design Span hp, Net coverage 16 inches, rib depth 1 3/4 inches

2.2 MATERIALS

A. PANELS

1. Base Metal

Steel conforming to ASTM A924/ASTM A792 Grade 40 or ASTM A446 Grade C, thickness 24 gauge.

2. Coatings

Protective coatings conform to ASTM A525 G90 or ASTM A924/ASTM A792, AZ50.

3. Finish

Exterior finish includes a 0.2 mil thick corrosion-resistant primer and a 0.8 mil thick finish coat of Polyvinylidene Fluoride (PVF₂), full 70 percent Kynar 500®/Hylar 5000® for a total 1.0 mil dry film thickness.

4. Color

Manufacturer's standard selection of not less than 12 colors.

B. ACCESSORIES

1. Fasteners

Per manufacturer's recommendations.

2. Sealant

- a. Gunnable Grade Caulking: Single component Urethane Caulk.
- b. Tape Sealant: Butyl.

3. Profile Closures

Neoprene or polyethylene foam, die-cut or formed to panel configuration.

4. Flashing

Material, gauge, and finish to match panels. Do not use lead or copper.

5. Underlayment

No. 30 lb. asphalt non-perforated organic felt.

C. GUTTERS AND DOWNSPOUTS

Provide gutters and downspouts of same material as roof panels. Gutters are to be continuous and seamless. Downspouts are to be rectangular.

D. FABRICATION

Unless otherwise shown on the Plans or specified herein, fabricate panels in continuous one-piece lengths and fabricate flashings and accessories in longest practical lengths.

Roofing panels shall be factory formed. Field formed panels are not acceptable.

2.3 GUTTER AND DOWNSPOUT

Gutters and downspouts shall be formed from flat sheets. Downspouts anchorage shall conform with SMACNA requirements. Fasteners shall be same material and finish as panel, with soft neoprene washers.

PART 3 EXECUTION

3.1 EXAMINATION

Contractor shall inspect installed work of other trades and verify that such work is complete to a point where this work may continue. Verify that installation can be performed in accordance with approved shop drawings and manufacturer's instructions.

3.2 PREPARATION

A. FIELD MEASUREMENTS

Verify prior to installation. If field measurements differ from Plan dimensions, notify Engineer prior to fabrication.

B. PROTECTION

Treat, or isolate with protective material, any contacting surfaces of dissimilar materials to prevent electrolytic corrosion, comply with Section 09900. Require workmen who will be walking on roofing panels to wear clean, soft-soled shoes that will not pick up stones or other abrasive material, which could cause damage and discoloration.

C. SURFACE PREPARATION

Clean and dry surfaces prior to applying sealant.

3.3 INSTALLATION

A. PANELS

1. Follow metal panel manufacturer's directions and printed instructions.
2. Install roof panel seams vertically.
3. Install wall panel seams: vertically.
4. Lap panels away from prevailing wind direction.
5. Do not stretch or compress panel side-lap interlocks.
6. Secure panels without warp or deflection.

B. ALLOWABLE ERECTION TOLERANCE

Maximum Alignment Variation: 1/4 inch in 40 feet.

C. FLASHING

1. Follow manufacturer's directions and Engineer-approved shop drawings.
2. Overlap roof panels at least 6 inches.
3. Install flashings to allow for thermal movement.
4. Remove any strippable protective film, if used, immediately preceding flashing installation.

D. CUTTING AND FITTING

1. Provide neat, square and true. Torch cutting is prohibited where cut is exposed to final view.
2. Openings 6 inches and larger in any direction: Shop fabricate and reinforce to maintain original load capacity.
3. Where necessary to saw cut panels, debur and treat with galvanic paint coating to match factory color.

3.4 CLEANUP AND CLOSEOUT

A. PANEL DAMAGE AND FINISH SCRATCHES

Do not apply touch-up paint to damaged paint areas that involve minor scratches. Panels or flashings that have severe paint and/or substrate damage shall be replaced as directed by the Engineer.

B. CLEANING AND REPAIRING

At completion of each day's work and at work completion, sweep panels, flashing and gutters clean. Do not allow fasteners, cuttings, filings, or scraps to accumulate. Remove debris from project site upon work completion, or sooner, if directed by the Owner.

***** END OF SECTION *****

SECTION 07900

CAULKING AND SEALANTS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the furnishing of all labor, materials, tools, and equipment required to install caulking and sealants, as indicated on the Plans and as specified herein.

All exterior wall joints and interior and exterior joints between all differing or dissimilar materials and at windows, doors, roof penetrations, louvers and similar types of openings shall receive sealants to make the joint air and watertight. This includes concrete to CMU, concrete to wood, CMU to wood, concrete to sheet metal, CMU to sheet metal, etc.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
01310	Project Meetings
01400	Quality Control

1.3 REFERENCE STANDARDS

This Section references the latest revisions of the following documents:

<u>Reference</u>	<u>Title</u>
AAMA 800	Sealant Manual, Specifications and Test Methods for Sealants
ASTM C834	Standard Specification for Latex Sealants
ASTM C920	Standard Specification for Elastomeric Joint Sealants
ASTM C1193	Standard Guide for Joint Sealants
ASTM C1311	Standard Specification for Solvent Release Sealants
ASTM D5249	Standard Specification for Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints

ASTM D7174 Standard Specification for Preformed Closed-Cell
Polyolefin Expansion Joint Fillers for Concrete Paving and
Structural Construction

NSF/ANSI 61 Drinking Water System Components – Health Effects

PART 2 PRODUCTS

2.1 POLYURETHANE SEALANTS

Provide a one-component, gunnable grade, non-sag, solvent-free polyurethane sealant. The sealant shall cure under the influence of atmospheric moisture. Sealant shall meet ASTM C920, Type S, Grade NS, Class 35, under uses NT, T, M, G, I, A, and O. Performance characteristics shall include a 175 psi 21-day tensile strength, a minimum 500-percent ultimate elongation, and a maximum Shore “A” Hardness of 45.

Polyurethane sealants shall be Sikaflex-1a, as manufactured by the Sika Corporation, or equal by Tremco, Inc. or BASF Corporation.

2.2 SILICONE SEALANTS

Provide a one-component, gunnable grade, neutral cure, silicone sealant. Sealant shall meet ASTM C920, Type S, Grade NS, Class 50, under uses NT, M, G, A and O. Performance characteristics shall include a 200 psi 21-day tensile strength, a minimum 700-percent ultimate elongation, and a maximum Shore “A” Hardness of 25.

Silicone sealants shall be Sikasil WS-295, as manufactured by the Sika Corporation, or equal by Tremco, Inc. or BASF Corporation.

2.3 ACRYLIC LATEX CAULK

Provide a one-component, gunnable grade, pure acrylic latex sealant. Sealant shall meet ASTM C834, Type OP, Grade -18 °C. Performance characteristics shall include a maximum 25-percent shrinkage, and a movement capability of plus/minus 12.5-percent.

Acrylic latex sealants shall be Tremflex 834, as manufactured by the Tremco, Inc. or equal by BASF Corporation.

2.4 TAPE SEALANT

Provide a 100-percent solid, isobutylene preformed sealant tape. Tape sealant shall meet the American Architectural Manufacturer's Association AAMA 807.3 standard. Performance characteristics shall include a density of 1.5 and a minimum peel adhesion of 8 pounds per inch.

Tape sealant shall be Sikalastomer-95, as manufactured by the Sika Corporation, or equal by Tremco, Inc. or BASF Corporation.

2.5 PREFORMED FLEXIBLE JOINT MATERIAL

Provide a closed-cell, polyolefin preformed foam joint material. Foam joint material shall meet ASTM D7174. Performance characteristics shall include an expansion recovery greater than 99-percent, a maximum 50-percent compression strength of 15 psi, and a maximum water absorption of 0.25-percent by volume.

Foam joint material shall be Ceramar, as manufactured by W.R. Meadows, or equal.

2.6 PREFORMED FLEXIBLE JOINT BACKER MATERIAL

Provide a closed-cell, polyolefin preformed foam backer rod material. Backer rod material shall meet ASTM D5249 and shall be compatible with the proposed cold-applied sealant.

Backer rod material shall be Kool-Rod, as manufactured by W.R. Meadows, or equal.

2.7 PRIMERS

Provide primer materials made by or recommended by the sealant manufacturer for the conditions of the application, including the materials to be sealed at the joints and the type of sealant or caulking material to be used.

PART 3 EXECUTION

3.1 GENERAL

All sealant and primer work shall comply with ASTM C1193 and with the manufacturer's written instructions.

The Contractor shall confirm that the proposed sealant and primer materials are compatible with any concrete curing compound used, or the Contractor shall

lightly sandblast and thoroughly clean concrete joint surfaces prior to application of sealant materials.

All priming and sealant work shall be done under temperature and moisture conditions that are within the requirements of the manufacturer's written instructions.

All exterior dissimilar materials shall be sealed with elastomeric sealants at the joints between the different materials.

3.2 APPLICATION OF SEALANTS

A. PREPARATION OF JOINTS

Inspect profiles and surfaces of all joints prior to application. Verify joint dimensions are adequate for development of the sealant movement capability. All joints shall be solvent cleaned, dry, and free of dust, oils and grease before receiving backing materials and sealant. Floor joints shall be wire brushed, free of laitance or other residues. Aluminum or other metal surfaces to be in contact with sealants shall be wiped clean with xylol or an MEK solvent to remove any coatings or contamination. Joint sealants shall be installed before other surface finishes are applied. Proceed with joint sealant work only once conditions meet the manufacturer's requirements.

B. BACKINGS

Install filler and backer materials in as long of lengths as practicable. Stretch and force into joints with tool designed for that purpose, to a uniform depth, as indicated on the Plans or as required by the manufacturer, allowing for installation of sealant and caulking. Provide filler material in slab shapes for joints 1/2 inch or more in depth, and in 3/4 inch or more wide joints to receive sealing material. Provide extruded rod backer material in all other joints to receive sealant. Filler or backer material shall be of a depth as required to bring the top surface to within 1/2 inch of the slab surface, or as indicated on the Plans. All joints shall include a suitable bond breaker between backing materials and sealant.

C. MASKING

Both sides of joints shall be masked with tape to prevent soiling floor, slab, or wall beyond limits of the joint.

D. PRIMING

Apply primer to all surfaces of joints in contact with sealant materials. Apply full strength and undiluted in a uniform coating of surface. Allow to set or cure prior to proceeding. Do not prime surfaces at back of joint.

E. APPLICATION

Sealant shall be gun applied, giving the joint a full bead of sealant. Skin beads are not acceptable. Tool the bead immediately after application to ensure a firm and full contact with the inner faces of the joint. Joints in sills and other wash surfaces shall be filled slightly convex to obtain a flush joint when dry. Entire perimeter of openings in concrete surfaces shall be sealed. Do not apply sealants to wet or damp surfaces nor in temperatures below 50 degrees F, and as required by the manufacturer. Strike off excess sealant with tooling stick or a knife so that finished bead is slightly below surface. Remove excess sealant as work progresses. Sealants in masonry wall joints are to be a maximum of 1/2-inch deep and not less than 1/4 inch in each dimension. When applying sealant, do not permit thickness of sealant to exceed 1/2 of the width of the joint. Any joints over 1/2-inch wide shall be reported to the Owner and instructions for correcting the applications will be given.

3.3 CLEANUP

Upon completion, the Contractor shall remove and dispose of masking materials. Remove any excess materials and clean adjacent surfaces free from any soiling or staining resulting from the sealing and caulking operations.

***** END OF SECTION *****

DIVISION 8

DOORS AND WINDOWS

SECTION 08110

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section covers furnishing and installing hollow metal doors, frames, and glazing as indicated on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
01310	Project Meetings
01400	Quality Control
08700	Finish Hardware

1.3 REFERENCES

This Section references the latest revisions of the following documents:

<u>Reference</u>	<u>Title</u>
ANSI/SDI A250.8	Specifications for Standard Steel Doors and Frames
ANSI/SDI A250.11	Recommended Erection Instructions for Steel Frames
ANSI Z97.1	Safety Glazing Materials Used in Buildings – Safety Performance Specifications and Methods of Test
ASTM A653	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM C1048	Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass
ASTM E2190	Standard Specification for Insulating Glass Unit Performance and Evaluation
HMMA 840	Guide Specification for Installation and Storage of Hollow Metal Doors and Frames
NFPA 80	Standard for Fire Doors and Other Opening Protectives
NFPA 252	Standard Methods of Fire Tests of Door Assemblies
UL 10B	Standard for Fire Tests of Door Assemblies

1.4 QUALITY ASSURANCE

Hollow metal doors and frames shall conform to applicable requirements of ANSI/SDI A250.8.

Fire rated door and frame construction shall conform with NFPA 252, and UL 10B.

Fire rated door and frame installation shall conform to NFPA 80 for the fire rated class indicated in the Door Schedule on the Plans.

1.5 SUBMITTALS

Submit shop drawings and product data under provisions of Section 01300.

Indicate frame configuration, anchor types and spacing, location of cutouts for hardware, reinforcement, and finish.

Indicate door elevations and internal reinforcement.

1.6 REGULATORY REQUIREMENTS

Conform to applicable Building Code for frame and door requirements.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The hollow metal doors and frames shall be as manufactured by Curries, Ceco, Amweld, Republic, Steelcraft, or any other SDI member.

2.2 DOORS AND FRAMES

<u>Location</u>	<u>Material</u>
Exterior Doors and Frames	ANSI/SDI A250.8, Level 3, Model 2
Interior Doors and Frames	ANSI/SDI A250.8, Level 3, Model 2

Provide door and frame types and sizes as shown on the Plans.

2.3 DOOR CONSTRUCTION

Insulated doors shall contain a polyurethane core with a minimum U-value as shown on the Plans.

Non-insulated doors shall contain a honeycomb core.

2.4 ACCESSORIES

Rubber silencers shall be resilient rubber.

Glazing stops shall be rolled steel channel shape with mitered corners; prepared for countersink style tamperproof screw.

2.5 PROTECTIVE COATINGS

Coating	Material
Door Frame	See painting section, dissimilar metals system.
Primer	See painting section, metal doors, frames, and trim system.

2.6 FABRICATION

Provide fully welded frames for all new construction. Provide fabricated frames of knock down field assembly type for retrofit applications or for existing door openings.

Mullions for double doors shall be removable type. Provide metal T shaped astragals for double doors.

Fabricate frames and doors with hardware reinforcement plates welded in place. Provide mortar guard boxes.

Reinforce frames wider than 48 inches with roll formed steel channels fitted tightly into frame head, flush with top.

Prepare frame for silencers. Provide three single rubber silencers for single doors and mullions of double doors on strike side, and two single silencers on frame head at double doors without mullions.

Attach fire rated label to each frame and door unit, if required.

Close top edge of exterior doors flush with inverted steel channel closure. Seal weld all door joints watertight. Caulking of door seams is not acceptable.

2.7 FINISH

Both interior and exterior doors and frames shall be made from galvanealed zinc coating per ASTM A653 or A60 material, with a minimum application rate of 0.60 oz/ft². Finish painting shall be in accordance with Section 09900 of these Specifications.

The inside of the metal frame profile shall be coated per Section 09900 of these Specifications. Provide dissimilar metals system. Coating may be shop or field applied.

2.8 GLAZING

Doors with glass relites shall be furnished with formed steel glazing strip frame with attachment screws allowed only on the non-secure side. Glazing for insulated doors shall consist of insulated glass units preassembled with two glass panels separated by an argon filled interspace for a unit with a nominal 1/2-inch overall thickness. Insulated glass panels shall be manufactured in accordance with ASTM E2190. Glazing for non-insulated doors shall be nominally 1/4-inch thick. All glazing shall be fully-tempered in accordance with ASTM C1048 and shall meet the requirements of ANSI Z97.1.

PART 3 EXECUTION

3.1 INSTALLATION

Frames shall be installed plumb, level, and rigid in accordance with ANSI/SDI A250.11 and with HMMA 840. Doors shall be installed in accordance with HMMA 840.

Coordinate with all wall construction types for proper anchor placement. All door frames installed in masonry construction shall be completely filled with the masonry mortar utilized to install the masonry units or be fully grouted with non-shrink grout after installation of the frame. All door frames installed in cast-in-place concrete structures shall be fully grouted with non-shrink grout.

Install roll formed steel reinforcement channels between two abutting frames. Anchor frames to structure and floor.

Contractor shall protect doors and frames as necessary during construction of the Project.

3.2 CLEARANCES AND TOLERANCES

Clearances between the door and frame head and jambs shall be 1/8 of an inch. Clearances between the meeting edges of pairs of doors shall be 3/16 of an inch plus or minus 1/16. Maximum diagonal distortion shall be 1/8 of an inch, measured with straight edge, from corner to corner. Clearance between the face of the door and the door frame stops shall be 1/16 to 1/8 of an inch.

3.3 ADJUSTING DOORS

Adjust hardware for smooth and balanced door movement.

***** END OF SECTION *****

SECTION 08310

METAL ACCESS HATCHES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section consists of the Contractor furnishing and installing 10 aluminum access hatches and accessories as shown on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
01400	Quality Control
02530	Utility Structures
13212	Concrete Reservoir

1.3 QUALITY ASSURANCE

Access hatches shall be guaranteed against defects in material and/or workmanship for a period of 10 years by the manufacturer.

1.4 EQUIPMENT LIST

The metal access hatches to be installed are as follows:

<u>Location</u>	<u>Clear Opening</u>	<u>Type</u>
Inlet Vault	72" x 36"	Type 2

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

Metal access hatches shall be as manufactured by Halliday Products, Inc., Bilco, L. W. Hatch, or equal.

2.2 ACCESS HATCH TYPE 2

Type 2 access hatches shall be Halliday H1W series, or equal. The hatches shall have a 1/4-inch-thick one-piece mill finish, extruded aluminum channel frame, incorporating a continuous concrete anchor. A 1-1/2-inch drainage coupling shall be located in the front left corner of the channel frame, unless shown otherwise on

the Plans. A bituminous coating shall be applied to the frame exterior where it comes in contact with concrete. The door panel shall be 1/4-inch aluminum diamond plate reinforced to withstand a live load of the H-20 designation. The door shall open to 90 degrees and automatically lock with a stainless steel hold-open arm shall incorporate an enclosed stainless steel compression spring assist. The door shall close flush with the frame and rest on a built-in neoprene cushion/gasket. Hinges and all fastening hardware shall be stainless steel. The unit shall lock with a stainless steel slam lock with removable key and have a non-corrosive handle. The unit shall be guaranteed against defects in material and/or workmanship for a period of 10 years.

PART 3 EXECUTION

Units shall be installed as specified herein and as shown on the Plans. The units shall be connected with drain piping as shown on the Plans, and shall be installed according to the manufacturer's recommendations for safe and proper storage.

***** END OF SECTION *****

SECTION 08700

FINISH HARDWARE

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section specifies that the Contractor shall provide complete finish hardware and suitable fastenings for the project. Quantities listed in any instance are for supplier convenience only and are not guaranteed.

Finish hardware includes items known commercially as “builders’ hardware” required, for swinging doors. Hardware specified in the same section as the door and/or doorframe will be furnished by the supplier of that Section.

All hardware furnished in this Section shall comply with the requirements of all applicable codes. All items specified in this Section shall be furnished by a factory-authorized distributor maintaining parts, stocks, and services for standard specified items.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
01310	Project Meetings
01400	Quality Control
08110	Hollow Metal Doors and Frames

1.3 REFERENCES

This Section references the latest revisions of the following documents:

<u>Reference</u>	<u>Title</u>
ANSI/NFPA 80	Fire Doors and Windows
ANSI/NFPA 101	Code for Safety to Life from Fire in Buildings and Structures
UL	Building Materials List

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURER’S

Finish hardware shall be as manufactured by the suppliers listed in the following sections.

2.2 FINISHES

Finishes for hardware items specified shall be as follows:

<u>Hardware</u>	<u>Finish</u>
Butts	US26D/US32D
Locksets	US32D (630)
Closers	689
O.H. Stops	US26D
Thresholds	As listed
Misc.	US26D/US32D

2.3 BUTTS

Butts shall be 4-1/2" x 4-1/2" for 3'-0" and under and 5" x 4-1/2" for over 3'-0", except as required for 180-degree swing and shall be of the type listed. Doors up to and including 90 inches in height shall have 1-1/2 pair and doors over 90 inches in height shall have two pair. For unusual size or weight doors, furnish type, size, and quantity recommended by the butt manufacturer. All exterior-outswinging doors shall have non-removable pins. Butts shall be as manufactured by Stanley, or equal.

2.4 LOCKSETS

Locksets shall be of an LWA design with 2-3/4-inch backsets and shall be as manufactured by Corbin Russwin, or equal. All locksets and latchsets shall be the product of one manufacturer. All locksets and latchsets shall be heavy-duty mortise type UL approved for use on fire doors and 3/4-inch antifriction latch bolt. Functions as indicated in the hardware groups. Provide curved lip strikes. Deadbolt functions shall be 1-inch projection.

Locksets and latchsets shall be furnished with sufficient strike lip to protect trim. (note: 3/4-inch latch bolts require 3/4-inch minimum clearance for trim, otherwise extended lip strikes must be furnished).

All locks shall have wrought box strikes.

2.5 MANUAL FLUSH BOLTS

Manual flush bolts shall be as manufactured by Ives, or equal. Refer to hardware groups for sizes and types.

2.6 DOOR CLOSERS, SURFACE

Door closers shall be as manufactured by Norton, Corbin Russwin, or equal. Drop plates shall be furnished where required. Hex nuts and bolts shall be furnished for all doors.

Closers shall be provided as specified in hardware groups and shall have a 10-year guarantee.

2.7 STOPS

All doors are to have a wall stop WC9X series or floor stop F8061X series unless otherwise specified. Where wall stops are specified but cannot be used, substitute a floor stop. If wall stop or floor stop cannot be used, advise the Owner of the specific door during submittal process. Provide proper height floor stops to suit conditions. Contractor to provide solid backing for all wall mounted stops. Stops shall be as manufactured by Trimco, or equal.

2.8 GASKET, THRESHOLD AND RAIN DRIPS

Gaskets and thresholds shall be as specified in the hardware groups and shall be as manufactured by Pemko, or equal.

Provide rain drips at header of all exterior doors. Rain drips shall be extruded aluminum not less than 0.07 in thick, clear anodized or painted to match door frame color. Rain drips shall be approximately 1-1/2 high by 2-1/2 inches projection and shall extend 2 inches on either side of the door opening width.

2.9 DOOR SILENCERS

Door silencers shall be Glynn Johnson Type 64 or 65, or equal. The Contractor shall furnish three door silencers for each single doorframe, and four door silencers for each pair of doorframes.

2.10 KEYING

All cylinder items shall be furnished with visual key control with key code stamped on the face of the keys and marked on the back or side of the cylinders. All standard cylinder items shall be furnished with construction-keyed cylinders.

The Contractor shall coordinate the keying for door locks with the Owner.

2.11 KEY QUANTITIES

Keys shall be furnished in the following quantities:

<u>Type</u>	<u>Quantity</u>
MKs	6 each
Construction Keys	6 each
Change keys per keyed cylinder	2 each
Control keys	2 each

2.12 HARDWARE GROUPS

A. MANUFACTURER'S LIST

<u>Manufacturer</u>	<u>Abbreviation</u>
Stanley	ST
Corbin Russwin	CO
Norton	NO
Pemko	PE
Glynn Johnson	GJ
Richards Wilcox	RW
Ives	IV
Rixson	RX
Trimco	TR

B. Refer to door schedule and related information concerning the following hardware groups:

HW1 (exterior double door)

	Butts CB 1961	ST
1 ea.	Lockset ML2051 M26 LC	CO
1 ea.	Cylinder 1000-118-A01-6-XX 626	CO
1 ea.	Flush bolts 458B (bottom inactive)	IV
1 ea.	Dustproof strike 489B	IV
2 ea.	Wall stop WC9X	TR
1 ea.	Threshold 171 MS & ES	PE
1 ea.	Door bottom 315N	PE
1 set	Gasket 305R	PE
	Astragal by door manufacturer	

PART 3 EXECUTION

3.1 INSTALLATION

Refer to A.S.A.H.C., B.H.M.A., and S.D.I. for mounting heights.

Unless a conflict arises, the following are standard mounting heights on some products. If a question or conflict should arise, the hardware supplier, if requested, shall assist the Contractor and Owner in determining mounting heights. All measurements are from finish floor except top butt.

A. BUTTS

Top 11-3/4-inch center of butt to top of door. Intermediate equal distance between top and bottom butts. Bottom 13-inch center of butt.

B. KNOB LOCKS

40-5/16 inch to center of strike DEADLOCKS: 60 inch to center of strike.

C. EXIT DEVICES

40-5/16 inch to center of strike PUSH PLATES: 45 inch to center.

D. PULL PLATES

42 inch to center DOOR CLOSERS: as per manufacturer's instructions.

E. RAIN DRIPS

Align rain drips with bottom edge of doorframe rabbet. Drips shall be set in sealant and fastened with stainless steel screws.

3.2 ADJUSTING

Hardware shall be adjusted for correct operation.

After installation of hardware and before the building is accepted, Contractor shall inspect the installation and certify that the hardware is correctly installed in accordance with the manufacturer's recommendations. Hardware installer shall make any necessary adjustments.

***** END OF SECTION *****

DIVISION 9

FINISHES

SECTION 09900

PAINTING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section covers the furnishing and installation of protective coatings, complete-in-place. Special shop coatings and/or factory-applied finishes on manufactured or fabricated items may be specified elsewhere. Regardless of the number of paint coats previously applied, at least two field coats of paint shall be applied to all surfaces unless otherwise specified herein. Field painting is not required for factory prefinished equipment items such as pumps, blowers, motors, etc. Touchup of the factory applied coatings may be required.

The word “paint” as used herein shall be taken to include all protective coatings and incidental materials as redquired with the exception that anodized aluminum or zinc galvanized coatings shall not be considered as paint.

Unless specifically noted otherwise in these Specifications or on the Plans, all work performed under this Contract (both new work and modifications to existing facilities) shall be painted. If an existing wall or ceiling (or similar surface) is modified in someway, the entire wall or ceiling surface is to be painted.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
03300	Concrete
04200	Masonry
06200	Finish Carpentry
07620	Sheet Metal Flashing and Trim
07900	Caulking and Sealant
08100	Hollow Metal Doors and Frames
Division 11	Equipment
Division 13	Special Construction
Division 14	Conveying Systems
Division 15	Mechanical
Division 16	Electrical

1.3 REFERENCED STANDARDS

The following standards are referenced and shall be considered a part of these Specifications:

American National Standards Institute (ANSI):

A159.1, Surface Preparation Specifications;
Z53.1, Safety Color Code for Marking Physical Hazards

American Society for Testing and Materials (ASTM):

D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
E84, Standard Test Method for Surface Burning Characteristics of Building Materials

National Fire Protection Association (NFPA):

101, Life Safety Code

Steel Structures Painting Council (SSPC):

SP-1, Solvent Cleaning
SP-2, Hand Tool Cleaning
SP-3, Power Tool Cleaning
SP-5, White Metal Blast Clearing
SP-6, Commercial Blast Cleaning
SP-7, Brush-off Blast Cleaning
SP-10, Near-White Blast Cleaning
SP-11, Power Tool Cleaning
SP-13 Surface Preparation for Concrete Surfaces
VIS-89, Visual Standard

1.4 DEFINITIONS

A. PAINT

Includes fillers, primers, sealers, emulsions, oils, alkyds, latex, enamels, thinners, stains, epoxies, vinyls, urethanes, shellacs, varnishes and any other applied coating specified within these Specifications or shown on the Plans.

B. FINISHED ROOM OR SPACE

One that has a finish called for on Room Finish Schedule, or is indicated on the Plans, or is specified herein, to be painted.

C. PAINTING COVERAGE RATE

Coverage's expressed in SF/GAL/coat are the manufacturer's published theoretical coverage's in square feet per gallon per coat.

1.5 SUBMITTALS

In addition to the general submittal requirements listed in Section 01300, the following shall be submitted:

1. Written acknowledgment and certification that products submitted meet requirements of standards referenced in this Section.
2. Manufacturer's application instructions for primer and finish coats.
3. Manufacturer's surface preparation instructions.
4. Manufacturer's full line of color samples for color selection by Owner.
5. If products being used are manufactured by a company other than the specified reference standard, the Contractor must provide a complete comparison of the proposed products with the specified reference products per Part 2.1 requirements, including application procedure, coverage rates, and verification that product is designed for intended use. Information must be provided that demonstrates that manufacturer's products are equal to the performance standards of products manufactured by the Tnemec Company, which is the reference standard.
6. Manufacturer's approval of protective coating systems applicator.
7. List of Applicator's experience and qualifications. A minimum of 5-years of experience in the painting of water reservoir and booster station facilities required.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The following is an approved coating systems manufacturers list subject to compliance with the Specifications contained herein:

1. Ameron Protective Coatings Division.
2. Sherwin Williams.
3. Tnemec Company.
4. Or equal.

The specified coating shall be understood as establishing the type and quality of coating desired. Other manufacturers' products will be accepted provided sufficient information is submitted to allow the Engineer to determine that the coatings proposed are equivalent to those named. Proposed coatings shall be submitted for review in accordance with these Specifications. Requests for review of equivalency will not be accepted from anyone except the Contractor, and such requests shall not be considered until after the Contract has been awarded.

No substitutions shall be allowed that change the number of coats, thickness or generic type of paint required. All materials shall be brought to the jobsite in the original sealed and labeled containers of the paint manufacturer and shall be subject to inspection by the Engineer.

No coating materials other than those specified shall be brought to the jobsite. Thinners, driers and oils brought to the jobsite shall be only those recommended and approved by the paint manufacturer.

All paint shall conform to the applicable air quality regulations at the point of application. Any paint material which cannot be guaranteed by the manufacturer to comply, whether specified by product designation or not, shall not be used.

It shall be the responsibility of the Contractor to ensure the compatibility of the field painting products which will be in contact with each other or which will be applied over shop painted or previously painted surfaces. Paint used in successive field coats shall be produced by the same manufacturer. Paint used in the first field coat over shop painted or previously painted surfaces shall cause no wrinkling, lifting, or other damage to the underlying paint.

All paint used for intermediate and finish coats shall be guaranteed by the paint manufacturer to be fumeproof and suitable for wastewater plant atmospheres containing hydrogen sulfide. Any paint that cannot be so guaranteed shall not be used. Paint shall be lead-free and mercury-free if available, but in no case shall the lead or mercury content cause discoloration in a wastewater plant atmosphere.

Tnemec Company products are the reference standard and Tnemec designations for product type are used herein. Requirements for an approved equal product are listed below:

1. For approval of an equal manufacturer. The Contractor shall provide to the Owner in writing a detailed side-by-side comparison of the proposed equal Products Characteristics, Performance Characteristics, and Application Conditions for each Tnemec coating specified in this specification. For

consideration for approval this written comparison shall be certified and notarized by an officer of the proposed manufacturer as true and correct.

2. For Products Characteristics this detailed side-by-side comparison shall include for example, but not limited to, Volume Solids, Weight Solids, VOC, Mix Ratio, Zinc Content in Dry Film (by Weight), Spreading Rate per coat, Drying Schedule, Shelf Life and Flash Point.
3. For Performance Characteristics this detailed side-by-side comparison shall include for example, but not limited to, Abrasion Resistance, Corrosion Weathering, Direct Impact Resistance, Dry Heat Resistance, Flexibility, Moisture Condensation Resistance, Pencil Hardness, Salt Fog Resistance, Slip Coefficient and Wet Heat Resistance
4. In addition to the detailed side-by-side comparison for approval of an equal manufacturer, The Contractor shall provide to the Owner in writing five similar installations that have had the proposed or equal coating system and date coating system was put into service. In addition the installations names, locations, and owner's name with contact person and telephone number shall be provided.
5. For consideration for approval as an equal coating system the detailed side-by-side comparison shall be submit, with successful bidder's Shop Drawing at the time of the Preconstruction Conference, along with any proposed monetary adjustments to the contract price. As with all shop drawings, final approval rests with the Owner.
6. As a minimum standard any equal coating system shall have a 5-year service history on its coating system.

2.2 PAINT SYSTEMS

All paint systems in contact with potable water shall be NSF-61 certified for potable water use.

A. NON-SUBMERGED METAL - MILD CONDITIONS

1. Scope

This Section shall apply to all metal which is not submerged but is located indoors which is not subject to splashing from water, oil and grease or other corrosive materials unless specified otherwise.

2. Surface Preparation

Commercial blast cleaning, SSPC-SP-6.

3. Coatings

Shop Primer System:

Coat One

Product: Omnithane Series 1

MDFT: 2.5 to 3.5 mils

Field Finish System:

Coat One

Product: Hi-Build Epoxoline Tnemec Series N69

MDFT: 4.0 to 6.0 mils

Coat Two

Product: Hi-Build Epoxoline Tnemec Series N69

MDFT: 4.0 to 6.0 mils

Total MDFT: 10.5 to 15.5 mils

B. COATING OF FACTORY NON-APPROVED FINISHES

1. Scope

This Section shall apply to all interior and exterior steel windows and frames and other similar type of items which have a factory finish which is not an approved corrosion resistant finish.

2. Surface Preparation

Factory coating is to remain. Provide clean surfaces, lightly sand 100 percent of the surfaces, then provide solvent cleaning, SSPC-SP-1.

3. Coatings

Primer System:

Coat One

Product: Typoxy Tnemec Series N27

MDFT: 2.0 to 3.0 mils

Finish System:

Coat One

Product: Endura-Shield Tnemec Series 1095

MDFT: 3.0 to 5.0 mils

Total MDFT: 5.0 to 8.0 mils

C. EXTERIOR PVC SURFACES

1. Scope

This Section shall apply to all PVC pipe and fittings and similar materials that are located outside of buildings and vaults and are exposed to sunlight. Any and all PVC surfaces that are exposed to UV light are to be painted. Interior PVC items do not paint unless otherwise specified. Interior PVC pipe must be labeled and banded as specified.

2. Surface Preparation

Provide clean surfaces, lightly sand 100 percent of the PVC surfaces, then provide solvent cleaning, SSPC-SP-1.

3. Coatings

Finish System:

Provide One Coat of the following:

Product: Endura-Shield Tnemec Series 1095

MDFT: 3.0 to 5.0 mils

D. STRUCTURAL STEEL - MILD CONDITIONS

1. Scope

This Section shall apply to all interior structural steel. Items which are interior but may be exposed to splashing of liquids or corrosives shall be coated for severe conditions.

2. Surface Preparation

Commercial blast cleaning, SSPC-SP-6.

3. Coatings

Shop Primer System:

Coat One

Product: Omnithane Series 1
MDFT: 2.5 to 3.5 mils

Field Finish System:

Coat One

Product: Hi-Build Epoxoline Tnemec Series N69
MDFT: 4.0 to 6.0 mils

Coat Two

Product: Hi-Build Epoxoline Tnemec Series N69
MDFT: 4.0 to 6.0 mils

Total MDFT: 10.5 to 15.5 mils

E. STRUCTURAL STEEL - SEVERE CONDITIONS

1. Scope

This Section shall apply to all exterior structural steel components and structural steel items which are interior but may be exposed to splashing of liquids or corrosives.

2. Surface Preparation

Near-white blast cleaning, SSPC-SP-10.

3. Coatings

Primer System:

Coat One

Product: Series 1 Omnithane
MDFT: 2.5 to 3.5 mils

Finish System:

Coat One

Product: Hi-Build Epoxoline Tnemec Series N69
MDFT: 4.0 to 6.0 mils

Coat Two
Product: Endura-Shield Tnemec Series 1095
MDFT: 3.0 to 5.0 mils

Total MDFT: 9.5 to 14.5 mils

F. DUCTILE IRON PIPE AND FITTING MATERIALS (IMMERSION)

1. Scope

This Section shall apply to exposed ductile iron pipe, fittings and materials that are continuously or intermittently submerged or exposed to splash or spill of liquids or corrosive atmospheres. This includes all ductile iron materials installed in a vault or similar type of structure. Non-immersion service is covered elsewhere in this Specification.

2. Surface Preparation

Provide surface profile in accordance with ASTM D 4417, Method C

3. Coatings

Primer System:

Coat One
Product: Omnithane Series 1
MDFT: 2.5 to 3.5 mils

Finish System:

Coat One
Product: Pota-Pox N140
MDFT: 8.0 to 10.0 mils

Coat Two
Product: Pota-Pox N140
MDFT: 8.0 to 10.0 mils

Total MDFT: 18.5 to 23.5 mils

G. DUCTILE IRON PIPE AND FITTING MATERIALS
(NON-IMMERSION)

1. Scope

This Section shall apply to exposed ductile iron pipe, fittings and materials that are not continuously or intermittently submerged. Continuously or intermittently submerged items are covered elsewhere in this Specification.

2. Surface Preparation

Provide surface profile in accordance with ASTM D 4417, Method C

3. Coatings

Primer System:

Coat One

Product: Omnithane Series 1

MDFT: 2.5 to 3.5 mils

Finish System:

Coat One

Product: Hi-Build Epoxoline Tnemec Series N69

MDFT: 4.0 to 6.0 mils

Coat Two

Product: Endura-Shield Tnemec Series 1095

MDFT: 3.0 to 5.0 mils

Total MDFT: 9.5 to 14.5 mils

H. GALVANIZED SURFACE TOUCHUP

1. Scope

This Section shall apply to all galvanized surfaces, which have received minor damage to the galvanized surface during construction.

2. Surface Preparation

Power tool cleaning, SSPC-SP-6.

3. Coatings

Paint System:

Product:	TnemeZinc Tnemec Series 90-97
MDFT:	3.0 to 5.0 mils

Total MDFT:	3.0 to 5.0 mils
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I. ALUMINUM BURIED IN CONCRETE - DISSIMILAR METALS

1. Scope

This Section shall apply to all surfaces, which are conducive to corrosion due to interactions between dissimilar metals, or to chemical reactions, to include embedments in cast-in-place or precast concrete or masonry grout. This Section applies to aluminum, hot-dipped galvanized steel, and any other metals that have a dissimilar metals or chemical reaction concern when installed or embedded in concrete, or against concrete, mortar or grout.

2. Surface Preparation

Lightly sand with 150 grit sandpaper to degloss and roughen surfaces. Solvent cleaning, SSPC-SP-1.

3. Coatings

Finish Coat

Product:	Hi-Build Epoxoline Tnemec Series N69
MDFT:	4.0 to 6.0 mils

Total MDFT:	4.0 to 6.0 mils
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J. PLYWOOD AND EXTERIOR SOFFIT BOARD (ESB)

1. Scope

This Section shall apply to all exposed plywood and ESB surfaces.

2. Surface Preparation

Sandpaper smooth, dust and contaminant free.

3. Coatings

Primer System:

Coat One

Product: Sealer Tnemec Series 151-1051

MDFT: 1.5 to 2.5 mils

Finish System:

Coat One

Product: H. B. Tnemec-Tufcoat Tnemec Series 1029
EndurTone

MDFT: 2.0 to 4.0 mils

Coat Two

Product: H.B. Tnemec-Tufcoat Tnemec Series 1029
EnduraTone

MDFT: 2.0 to 4.0 mils

Total MDFT: 5.5 to 10.5 mils

K. METAL DOORS AND WINDOWS, FRAMES AND TRIM

1. Scope

This Section shall apply to all interior and exterior hollow metal doors and windows, frames and trim.

2. Surface Preparation

All hollow metal doors, windows and frames shall be bonderized, pickled or phosphatized, which will serve as the primer for and shall be compatible with the finish coats to be applied in the field. Prior to field coat application, the surface shall be solvent cleaned SSPC-SP-1, and shall be clean, dry and free of all dirt, oil, grease and any other contaminants.

3. Coatings

Primer System:

Coat One

Product: Tnemec Series 27 Typoxy

MDFT: 3.0 to 5.0 mils

Finish System:

Coat One

Product: Endura-Shield Tnemec Series 1095

MDFT: 3.0 to 5.0 mils

Total MDFT: 6.0 to 10.0 mils

L. PAINTED WOOD AND WOOD TRIM

1. Scope

This Section shall apply to all exposed to view interior and exterior wood and wood trim for buildings and structures. Color shall be selected by the Owner.

2. Surface Preparation

Wood surfaces shall be clean and dry. Sand wood as required.

3. Coatings

Primer System:

Product: Electrogrip, Tnemec Series 151

MDFT: 1.5 to 2 mils

Finish System:

Coat One:

Product: Envirocrete, Tnemec Series 156

MDFT: 3.0 to 4.0 mils

Coat Two:

Product: Envirocrete, Tnemec Series 156

MDFT: 3.0 to 4.0 mils

Total MDFT: 7.5 to 10.0 mils

2.3 COLORS

A. GENERAL

Paint colors used for the finish coatings on process equipment, piping and building surfaces shall conform to the following schedules. All finishes shall be glossy unless otherwise specified. Finish coatings, which are applied in the shop by the manufacturer, shall conform with this color

schedule wherever possible. Factory coatings which are damaged during shipment or installation, or which are not of suitable color, as determined by the Engineer, shall be recoated in the field in accordance with these Specifications. Color samples shall be submitted to the Engineer for approval prior to application of any field coatings.

B. PROCESS EQUIPMENT COLOR SCHEDULE

Process equipment to include shall be painted in accordance with the following color schedule:

Process Unit	Color
(A) Pumps	Blue

Other equipment items and process materials shall be painted with finish colors selected by the Engineer.

C. PIPING COLOR SCHEDULE

Piping Identification: Exposed piping and piping in accessible chases shall be identified with lettering or tags designating the service of each piping system, shall have flow directional arrows, and shall be color coded as scheduled below.

Piping scheduled to be color coded shall be completely painted with the indicated colors, except surfaces specified to be unpainted shall have segments painted with the specified coding color long enough to accommodate the required lettering and arrows. All other piping specified to be painted shall match adjacent surfaces, unless otherwise approved by the Engineer.

Location: Lettering and flow direction arrows shall be provided near equipment served, adjacent to valves, on both sides of walls and floors where pipe passes through, at each branch or tee, and at intervals of not more than 50 feet in straight runs of pipe. If, in the opinion of the Engineer, the foregoing requirements will result in an excessive number of labels or arrows on a run of pipe, the number required can be reduced.

Metal Tags: Where the outside diameter of pipe or pipe covering is 5/8 inch or smaller, metal tags shall be provided instead of lettering. Tags shall have the specified identifying lettering stamped in, and shall be fastened to the pipe with suitable chains. Metal tags and chains shall be aluminum or stainless steel. Where tags are used, pipe shall be color coded as specified.

Lettering: Lettering on piping shall be painted, stenciled, or snap-on markers. Snap-on markers shall be plastic sleeves as manufactured by Brady “Brady snap-on B-915,” Seton “Setmark,” or equal. Letter sizes shall be as follows:

<u>Outside Diameter of Pipe or Covering</u>	<u>Minimum Height of Letters</u>
5/8 inch and smaller	Metal tags - 1/4 inch
3/4 inch through 4 inch	3/4 inch
5 inch and larger	2 inches

Color Coding and Lettering Schedule: All piping for the following services shall be color coded and identified using the process names given below. Where scheduled, pipe shall be fully coated.

<u>Process</u>	<u>Abbreviation</u>	<u>Color of Pipe</u>	<u>Color of Letters</u>
Drain	D	Dark Gray	White
Overflow	OF	Gray	Black
Water	W	Dark Blue	White
Vent	V	Dark Gray	White

All exposed piping shall be color coded and lettered. Pipes not tabulated above shall be color coded and lettered as determined by the Engineer.

Electrical conduit shall be painted to match adjacent ceiling or wall surfaces as approved by the Engineer. Vent lines shall be painted to match surfaces they adjoin, otherwise gray.

All valves shall be identified with a valve identification number. Contractor shall provide a computer file (Excel spreadsheet) with this information to the Engineer.

PART 3 EXECUTION

3.1 GENERAL

It is the intent of these Specifications that materials and workmanship be provided such that the highest quality job is obtained. The completed work, prior to acceptance, must be free from runs, skips, mars and any other disfiguring mark due to faulty workmanship or care of the completed work.

It is the responsibility of the Contractor to ensure that all surfaces are prepared in accordance with the written recommendations and directions of the paint manufacturer whose paint is applied.

Approval of conditions shall be obtained from the Engineer prior to applying any or all coats of paint; however, such approval shall not relieve the Contractor of their responsibility of conformance with these Specifications and conformance with the manufacturer's recommendations.

It shall be the responsibility of the Contractor to prevent settling of dust or the occurrence of other conditions detrimental to the finished quality of the job and to repair any damaged paint at no additional cost to the Owner.

Materials or equipment delivered with prime coats shall be touched up as required prior to the application of additional coating(s).

The Contractor shall apply each coating at the rate and in the manner specified by the paint manufacturer. If material has thickened or must be diluted for application by spray gun, the coating shall be built-up to the same thickness achieved with undiluted material. Deficiencies in film thickness shall be corrected by the application of an additional coat(s) of paint. Film thickness shall be determined when dry by the Engineer with a magnetic dry film thickness gauge. The thickness gauge shall be calibrated with test shims.

Where thinning is necessary, only the products of the manufacturer furnishing the paint and for the particular purpose shall be allowed. All thinning shall be done strictly in accordance with the manufacturer's instructions as well as with the full knowledge and approval of the Engineer.

No paint shall be applied when the surrounding air temperature, as measured in the shade, is below 40 degrees F. No paint shall be applied when the temperature of the surface to be painted is below 35 degrees F. Paint shall not be applied to wet or damp surfaces and shall not be applied in rain, snow, fog or mist or when the relative humidity exceeds 85 percent. No paint shall be applied when it is expected that the relative humidity will exceed 85 percent or that the air temperature will drop below 40 degrees F within 18 hours after the application of the paint. Dew or moisture condensation should be anticipated and if such conditions are prevalent, painting shall be delayed until conditions improve to be certain that the surfaces are dry prior to application of paint. No paint shall be applied when the ambient temperature is less than 5 percent F. above the dewpoint. Further, the day's painting shall be completed well within advance of the probable time of day when condensation will occur, in order to permit the paint film an appreciable drying time prior to the formation of moisture.

Manufacturer's recommended drying time shall be construed to mean "under normal conditions." Where conditions are other than normal because of the weather or because painting must be done in confined spaces, longer drying times shall be necessary. The manufacturer's recommendations for recoating time intervals shall be strictly adhered to.

Adequate ventilation, which will effectively remove solvents, shall be provided for proper drying of paints on interior surfaces. A minimum of 7-consecutive calendar days at 70 degrees F following the application of the final coat on submerged surfaces shall be required before submergence. Longer periods shall be allowed prior to submergence if recommended by the paint manufacturer or if weather conditions require a longer curing time.

3.2 MIXING AND THINNING

Paint shall be thoroughly mixed each time any is withdrawn from the container. Paint containers shall be kept tightly closed except while paint is being withdrawn.

Paint shall be factory mixed to proper consistency and viscosity for hot weather application without thinning. Thinning will be permitted only as necessary to obtain recommended coverage at lower application temperatures. Only thinners approved by the paint manufacturer shall be used. In no case shall the wet film thickness of applied paint be reduced, by addition of paint thinner or otherwise, below the thickness recommended by the paint manufacturer.

3.3 SURFACE PREPARATION

A. GENERAL

Surfaces shall be dry and thoroughly cleaned of foreign materials with all defects filled or removed. All trades employed shall leave the surfaces of their work in such a condition that only minor cleaning, sanding and filling is required of the painting trade for surface preparation.

Hardware, switchplates, machined surfaces, nameplates, lighting fixtures and all other surfaces not to be painted shall be removed or otherwise protected. Drop cloths shall be provided, where necessary, to avoid spotting of surfaces adjacent to the item being painted. Working parts of electrical equipment shall be protected from damage during surface preparation and painting operations.

Ferrous metal cleaning shall be in accordance with Steel Structures Painting Council Specifications (SSPC).

<u>Description</u>	<u>SSPC</u>
White Metal Blast Cleaning	SP-5
Commercial Blast Cleaning	SP-6
Brush-Off Blast Cleaning	SP-7
Near-White Blast Cleaning	SP-10
Preparation of Concrete	SP-13

The words “blast cleaning” or equivalent phrases of equal intent shall be taken to refer to the applicable SSPC specification when used in the paint manufacturer’s recommendations or these Specifications.

Hand tool cleaning shall be used when power tool cleaning is not possible. Hand and power tool cleaning shall be in accordance with SSPC Specifications SP-2, SP-3 or SP-11, respectively.

The blast cleaning profile depth shall be not less than 1 mil or greater than 2 mils. In the case of equipment to which the manufacturer applies a primer coating in the shop after fabrication, the blast profile depth needs to be as noted above.

B. WOOD

The Contractor shall sandpaper smooth, then remove dust. After prime coat has dried, seal all knots, pitch and resinous sapwood. The Contractor shall putty nail holes and minor defects prior to painting.

C. FERROUS METAL, GALVANIZED METAL AND HOLLOW METAL SURFACES

The Contractor shall assure that fabrication, welding or burning is completed prior to the sandblasting operation. The Contractor shall chip or grind off flux, splatter, slag or other laminations left from welding. The Contractor shall remove all mill scale. The Contractor shall grind smooth rough welds and other sharp projections.

The Contractor shall near-white blast clean, in accordance with SSPC SP-10, submerged surfaces and surfaces to 12 inches above highest liquid level, and areas subject to splash or spillage.

The Contractor shall commercial blast clean, in accordance with SSPC SP-6, all interior and exterior structural steel surfaces, surfaces located 12 inches above submerged areas, and surfaces located in areas not subject to splash or spillage where exposed to open bodies of liquids.

The Engineer reserves the right to accept preparation of these surfaces in accordance with SSPC SP-3 for areas not practical or possible to sandblast to SSPC SP-6 requirements.

The Contractor shall near-white blast clean, in accordance with SSPC SP-10 surfaces, subject to heat in excess of 600 degrees F. The Contractor shall power tool or hand clean in accordance with SSPC SP-2 or SSPC SP-3. The Contractor shall apply prime coat on cleaned surfaces within 2 hours of cleaning. The Contractor shall solvent clean galvanized surfaces in accordance with SSPC SP-1.

D. EQUIPMENT

The Contractor shall sandblast the following equipment items or surfaces in accordance with applicable SSPC standards whether prime coated or not:

Shop primed surfaces, which have 2 percent or more of the primed surface damaged.

If catalyzed epoxy prime coat has been exposed to sunlight for longer than 60 days.

E. GYPSUM WALLBOARD

The Contractor shall repair minor irregularities left by finishers, avoid raising the nap of the paper and verify that the moisture content is less than 8 percent before painting. Contractor shall install sealant as required at edges of wallboard where it abuts different materials prior to painting.

F. CONCRETE AND CONCRETE BLOCK MASONRY

The Contractor shall allow new concrete and concrete block masonry to cure for a minimum of 28 days and shall verify that the moisture content contained in the concrete is stable and not in motion. The Contractor shall verify by performance of a Wet Matt Test per ASTM D4263. The Contractor shall fill concrete surface cracks and irregularities with Portland cement grout to provide a uniform surface texture and shall fill concrete block masonry surface with an epoxy block filler as specified. As a minimum, the Contractor shall brush off blast clean surfaces. The Contractor shall prepare the surface as specified elsewhere in these Specifications.

D. CONCRETE BLOCK MASONRY

The Contractor shall verify that the moisture content is acceptable as noted above, shall remove existing paint that has a tendency to powder, peel or shatter when scraped with a knife, shall hydroblast or sandblast the surfaces of any previous coatings, shall fill cracks and irregularities with portland cement grout to provide a uniform surface texture compatible with new concrete and shall fill concrete block masonry surfaces with a block filler.

G. PREPARATION BY SANDBLASTING

The Contractor shall not sandblast surfaces that will be wet after blasting and before painting. The Contractor shall apply primer to sandblasted surfaces the same day that the surface is blasted and before rusting occurs. The Contractor shall reblast surfaces allowed to set overnight prior to priming or surfaces that show rust bloom.

The sand shall be clean, water washed, with controlled particle size and high silica content. The sand shall have sharp, angular surfaces and contain no clay particles or other extraneous matter.

The profile depth of sandblasted surfaces shall be not less than 1 mil or greater than 2 mils, unless required otherwise by the coating manufacturer.

Compressed air for blasting shall be free of water and oil. The Contractor shall provide accessible separators and traps, shall confine sandblast sand to the area being blasted, shall provide shields of polyethylene sheeting or other such barriers to confine sand and shall plug pipes, holes or openings before sandblasting and keep them plugged until the sandblasting operation is complete and the sand is removed.

The Contractor shall protect nameplates, valve stems, rotating equipment, motors and other items that may be damaged from sandblasting. The Contractor shall reblast surfaces not meeting the requirements of these Specifications.

3.4 APPLICATION

A. GENERAL

The Contractor shall mix and apply coatings by brush, roller or spray in accordance with the manufacturer's installation instructions. Spraying equipment shall be inspected and approved in writing by the coating manufacturer. The Contractor shall provide complete coverage's to the

mil thickness specified. The thickness specified shall be dry film mil thickness. All paint systems are “to cover.” In situations of discrepancy between the manufacturer’s square footage coverage rates and mil thickness, mil thickness requirements govern. When color or undercoats show through, the Contractor shall apply additional coats until paint film is of uniform finish and color. The Contractor shall not apply consecutive coats until the Engineer has had an opportunity to observe and approve previous coats.

The Contractor shall apply materials under adequate illumination, shall evenly spread and flow on to provide full, smooth coverage, shall work each application of material into corners, crevices, joints and other difficult to work areas, shall avoid degradation and contamination of blasted surfaces and avoid intercoat contamination, shall clean contaminated surfaces before applying next coat and shall immediately smooth out runs or sags, or remove and recoat entire surfaces. The Contractor shall assure that preceding coats are dry before recoating, shall recoat within the time limits specified by the coating manufacturer and shall allow coated surfaces to cure prior to allowing traffic or other work to proceed.

The Contractor shall coat all aluminum surfaces in contact with dissimilar materials. All fabricated and structural steel shall have prime coat(s) applied in the shop and finish coat(s) applied in the field.

During application of either prime or finish coats, brush coat all weld seams, edges, angles, fasteners and other irregular surfaces to insure a monolithic film, pinhole free surface. Finish coats of paint shall be uniform in color and sheen without streaks, laps, runs, drips, sags or missed areas.

All submerged or intermittently submerged materials shall have surface preparation and coatings applied prior to installation unless otherwise approved by the Engineer. All pipe, pipe supports, and pipe hangers that will be painted shall have surface preparation and coatings applied prior to installation.

B. PRIME COAT INSTALLATION

The Contractor shall prime all surfaces indicated to be painted, shall touch-up damaged primer coats prior to finish coats and shall assure field-applied coatings are compatible with factory-applied coatings. If coatings are not compatible, and if approved in writing by the Engineer, the Contractor shall apply a 2-mil-thick universal barrier coat recommended

by the paint manufacturer prior to applying field coats or completely remove factory coatings and reprime.

The Contractor shall prime ferrous metals bedded in concrete to a minimum of 1 inch below exposed surfaces. The Contractor shall backroll all primer coats applied to existing or new CMU block. The Contractor shall assure sandblasting operations do not result in the embedment of sand particles in paint film. The Contractor shall brush or spray bolts, welds, edges and difficult access areas with primer prior to primer application over the entire surface being coated. The Contractor shall backroll concrete, masonry, gypsum board and plaster surfaces with a roller if the primer has been spray applied.

C. FINISH SCHEDULE

All work performed under this Contract (both new work and modifications to existing facilities) shall be painted. If the finish schedule requires wall surfaces to be painted in a particular space, the Contractor shall paint all appurtenant surfaces unless specifically noted not to be painted on the Plans. These items to be painted shall include:

1. Pipe supports, and equipment supports.
2. Insulated or wrapped piping, valves, fittings, hydrants and appurtenances except where covered by lagging.
3. Insulated or wrapped ductwork and appurtenances.
4. Conduit and appurtenances.
5. Ferrous metals.
6. Exposed woodwork.
7. Copper and brass surfaces.
8. New machinery and equipment except:
 - a. Electrical panels;
 - b. Switchboards;
 - c. Switchgear;
 - d. Safety switches;

- e. Motor starter equipment;
- f. Busways;
- g. Raceways.

The Contractor shall paint the following surfaces in areas not considered as finished areas:

- 1. Insulated or wrapped piping, valves, fittings, yard or fire hydrants and appurtenances.
- 2. Insulated or wrapped ductwork and appurtenances.
- 3. Exposed wood.
- 4. New machinery and equipment.
- 5. Machinery and equipment in sumps, pits, boxes, channels, wetwells and structures.

The Contractor shall paint all exposed interior and exterior surfaces including:

- 1. Soffits.
- 2. Insulated or wrapped piping, valves, fittings, yard or fire hydrants and appurtenances except when covered by lagging.
- 3. Insulated or wrapped ductwork and appurtenances except when covered by lagging.
- 4. Conduit and appurtenances.
- 5. Ferrous metals.
- 6. Exposed wood.
- 7. Plaster surfaces.
- 8. Concrete block to be sealed, paint interior surfaces only.

The Contractor shall not paint the following elements unless specifically noted on the Plans to be painted:

1. Stainless steel surfaces except as required to identify piping.
2. Exposed to view aluminum surfaces.
3. Galvanized metal surfaces.
4. Fiberglass surfaces except fiberglass piping and piping appurtenances.
5. FRP ductwork unless gel coat color is not acceptable to the Owner.
6. Interior of pipe, ductwork, and conduits.
7. Moving parts of mechanical and electrical units.
8. Code labels and equipment identification and rating plates.
9. Piping, ductwork, or pipe conduit when enclosed between suspended ceiling and overhead slabs or located in pipe chases or surfaces to be lagged.
10. Factory-finished furniture, laboratory casework, metal toilet partitions, kitchen units, lockers, shop and storage equipment or miscellaneous items that have preapproved factory applied finishes.
11. Prefaced masonry, burnished masonry units, or glass masonry.
12. Structural steel or steel deck required to be fireproofed.
13. Contact surfaces of friction-type connections.
14. Pipe and/or duct lagging.

3.5 FIELD QUALITY CONTROL

The Contractor shall be responsible for performing, testing and assuring conformance with all requirements of these Specifications.

The Contractor shall maintain daily records showing:

- Start date of work in each area.
- Date of application for each following coat.
- Moisture content and surface temperature of substrate. Also record weather conditions, ambient air temperature and dew point.
- Provisions utilized to maintain temperature and humidity of work area within paint manufacturer's recommended ranges.

The Contractor shall measure the surface temperature of items to be painted with surface temperature gauges specifically designed for such use. The Contractor shall measure substrate humidity with humidity gauges specifically designed for such use. The Contractor shall measure wet paint with wet film thickness gauges. The Contractor shall measure paint dry film thickness with a Mikrotest gauge calibrated against the National Bureau of Standards "Certified Coating Thickness Calibration Standards." The Engineer may direct measurement of paint thickness at any time during the project to ensure conformance with these Specifications. A sufficient number of dry film thickness measurements shall be made so that there is approximately one measurement for each 100 square feet of surface area painted.

Where a wall or ceiling or other type of surface is disturbed and patched, the Contractor shall repaint entire wall or ceiling. The Contractor shall provide wet paint signs as necessary. The Contractor shall touch up damaged finish coats using the same material as specified for the finish coat.

At the conclusion of all painting activities, Contractor shall submit a painting field test report to the Engineer showing the above information plus results of wet film and dry film thickness tests. Provide four copies of final test report.

3.6 PAINTING SITE

Either shop painting or field painting and surface preparation shall be acceptable when painting work is performed in conformance with this Section, unless the painting is activity specified elsewhere in these Specifications.

3.7 PAINT THICKNESS

All paint thicknesses specified herein are minimum dry film thickness (MDFT). The thickness of paint over metallic surfaces shall be measured with a magnetic thickness gauge; paint thickness over wood or masonry shall vary in accordance with surface texture, but in no case shall the manufacturer's recommended

coverage rate be exceeded. The minimum thicknesses given are total coating thickness for the coating specified, including multiple coats of the same material, where applicable.

***** END OF SECTION *****

DIVISION 11

EQUIPMENT

SECTION 11000

EQUIPMENT GENERAL PROVISIONS

PART 1 GENERAL

1.1 SCOPE

The provisions of this Section apply to all Sections of Divisions 11, 13, 14, 15, and 16, unless specifically revised therein.

The Contractor shall direct the attention of all subcontractors and suppliers of equipment and related appurtenances for the work to the applicable provisions in the Contract Provisions wherever they may occur.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning and Training
03300	Cast-in-Place Concrete
09900	Painting
11010	Vibration and Critical Speed Limitations
Division 11	Equipment
Division 13	Special Construction
Division 15	Mechanical
Division 16	Electrical

1.3 STANDARDS FOR THE WORK

Pipe, fittings, wiring and supports shall be provided to produce complete, operable systems with all elements properly interconnected as shown in schematic diagrams or to provide specified operations. If a specific dimensioned location is not shown for interconnections or smaller system elements, the Contractor shall select appropriate locations and show them on Shop Drawing submittals for review.

Equipment and material shall be new and without imperfections and shall be erected in a neat and workmanlike manner; aligned, leveled, cleaned and adjusted for satisfactory operation; installed in accordance with the recommendations of the manufacturers and the best standard practices for this type of work so that connecting and disconnecting of piping and accessories can be readily made and so that all parts are easily accessible for inspection, operation, maintenance and repair. Oil and lubrication fittings shall be located clear of and away from guards,

base, and equipment and within reach from the operating floor. In order to meet these requirements with equipment as furnished, minor deviation from the Plans may be made as authorized by the Engineer. All such minor deviations from the Plans that may include extending oil and lubrication fittings for accessibility and safety shall be executed at no additional cost to the Owner.

1.4 MANUFACTURER'S INSTRUCTIONS

The recommendations and instructions of the manufacturers of products used in the work are hereby made part of these Specifications, except as they may be superseded by other requirements of these Specifications.

1.5 SUBMITTALS

A. GENERAL

Product Submittals shall be provided to the Engineer for all equipment specified in Divisions 11, 13, 14, 15, and 16, in accordance with Specification 01300, this Section and the respective equipment specification section. Submittals shall be dated and signed as certified for use in construction of this project.

B. MANUFACTURER'S LITERATURE

Manufacturer's literature shall be submitted for equipment, including, as applicable, performance characteristics, fan curves and pump curves, motor data sheets and methods of assembly.

The following minimum requirements shall accompany all manufacturers' literature submittals:

1. Description of materials.
2. Rating data - Mechanical and Electrical as applicable.
3. Motor Data including bearing and enclosure information.
4. List of any special tools and/or spare parts required and to be furnished, if any.
5. Exceptions taken to the specification and detailed explanation why the exception is being taken.
6. Additional specific information that is specified in the equipment sections.

7. For motor driven equipment served by variable frequency drives (VFDs), provide vibration and critical speed requirements of the equipment, minimum speed requirements of motor and driven machinery, acceleration and deceleration requirements of the equipment, and torque and speed information as per Part 1.6 of this Section.

C. SHOP DRAWINGS

Shop Drawings shall be submitted showing sizes and arrangement of equipment, foundations and anchor bolts required, control diagrams, wiring diagrams, pipe hanging details, ductwork layouts and connections to other work. The arrangement of mechanical equipment and appurtenant piping shown on the Plans may be varied as necessary to fit the certified manufacturer's installation drawings. However, the manufacturer's drawings shall not deviate from the Plans and Specifications as to location, size, type and design of equipment.

The following minimum requirements shall accompany all shop drawing submittals:

1. Overall dimensions.
2. Mounting arrangement and dimensions.
3. Connection sizes and orientation.
4. Capacity and location of lifting eyes.
5. Motor arrangement showing location of electrical connections.
6. Detail electrical wiring diagrams, showing component designation and rating, and the connection points and associated terminals and cable identification for connection to the process control system.
7. The Contractor shall ascertain the location of all electrical (power and control) connections in order to properly orient electrical conduits.

D. DESIGN CALCULATIONS

Seismic design calculations shall be submitted for equipment and for supports and anchorage for equipment.

Special seismic certification shall be submitted for all active mechanical and electrical equipment that must remain operable following an earthquake in compliance with ASCE 7-10 *Minimum Design Loads for Buildings and Other Structures*, Chapter 13 Seismic Design for Nonstructural Components.

E. FACTORY TEST REPORTS

Factory tests shall be performed for each piece of equipment where specifically called for in the Section specifying that equipment. Note that factory tests are inherent in many reference standards. The requirement for a factory test in a referenced standard shall make that requirement a part of these Specifications. Conduct factory tests at the same speeds at which the equipment will operate in the field except as noted.

Where specifically noted, the Engineer may witness performance test. The Contractor shall inform the Engineer in sufficient time to allow arrangements to be made for witness of such tests. When non-witnessed tests are performed, certified results shall be supplied by the Contractor to the Engineer.

Factory testing of pumps shall be done in accordance with the requirements and standards of the Hydraulic Institute. Tests of other equipment shall conform to the requirements set forth in these Specifications.

F. IDENTIFICATION OF DELIVERED EQUIPMENT

Each piece of equipment delivered to the project site shall be accompanied by a completed form which will contain at least the following information:

1. Owner's name and location of project.
2. Contractor's name and subcontractor if applicable.
3. Name of item being submitted.
4. Specification reference by section, paragraph and page.
5. Data on item (manufacturer, general descriptive data, dimensions, size of connections, speeds, performance curves, serial number).
6. Motor data, type, voltage, frequency, phase, full load amperes, starting method, frame size, enclosure, insulation type, NEMA Code letter, dimensions, service factor, serial number.

7. Date and signature of person certifying performance.

G. MANUFACTURER'S AFFIDAVITS

Equipment manufacturers, or their authorized representatives, shall each submit a signed and dated written report with respect to their equipment certifying the following:

1. The equipment has been properly installed and lubricated
2. The equipment is in accurate alignment
3. The manufacturer was present when the equipment was placed into operation
4. The manufacturer has checked, inspected, and adjusted the equipment as necessary
5. The equipment is free from any undue stress imposed by connecting piping or anchor bolts
6. The equipment is not imposing any undue stress on any connecting members
7. The equipment has been operated satisfactorily under full load conditions
8. The manufacturer has inspected their equipment during the operational demonstrations and system validation tests to the extent specified
9. The equipment is fully covered under the terms of the guarantee

PART 2 PRODUCTS

2.1 DESIGN

All equipment shall be designed for the service intended, of rugged construction, of ample strength for all stresses which may occur during fabrication, transportation, erection and during continuous or intermittent operation, shall be adequately stayed, braced and anchored, and shall be installed in a neat and workmanlike manner. Appearance, safety, and utility shall be given consideration in the design of equipment. Materials of construction shall be cathodically compatible.

2.2 STANDARD REQUIREMENTS

A. MATERIALS

Design, fabricate and assemble equipment and systems with new materials and in accordance with acceptable engineering and shop practices. Manufacture individual parts to standard sizes and gauges so repair parts can be installed in the field. Make like parts of duplicate units interchangeable. Do not place equipment in service at any time prior to delivery except as required for factory or shop tests.

B. UNIFORMITY

Unless otherwise specified, equipment or material of the same type or classification used for the same purpose shall be the product of the same manufacturer and shall be the same model.

C. SEISMIC REQUIREMENTS

Supports and anchorage of equipment(s) shall comply with the requirements of the 2015 *International Building Code* (IBC) Section 1613 and ASCE 7-10 *Minimum Design Loads for Buildings and Other Structures*, Chapter 13 Seismic Design for Nonstructural Components, as referenced and amended by the IBC. For the following design parameters:

- Risk Category IV
- Site Class D
- The component Importance Factor: $I_p = 1.5$
- Design response acceleration coefficients:

$$S_{DS} = 1.247g$$

$$S_{D1} = 0.666g$$

- Seismic Design Category D

D. STANDARDS

Provide equipment and materials suitable for service conditions and meeting standard requirements of ANSI, ASME, AWWA, ASTM, NEMA, IBC, NPC, UL and OSHA.

2.3 LUBRICATION

Provide lubricants of types recommended by equipment manufacturers, in quantities sufficient for a minimum of 1-year's consumption prior to completion, testing and final acceptance.

2.4 EQUIPMENT BASES AND BEDPLATES

Mount equipment assemblies on a single heavy cast iron or welded steel bedplate on a grout or concrete base unless otherwise shown or specified. Provide bases and bedplates with machined support pads, vibration pads, tapered dowels for alignment or mating of adjacent items, adequate openings to facilitate grouting, and openings for electrical conduits. Corners shall be rounded or chamfered and ground smooth. Continuously weld seams and contact edges between steel plates and shapes, and grind welds smooth. Do not support machinery or piping on bedplates other than that which is factory installed. Provide leveling screws in equipment bases and bedplates to aid in leveling prior to grouting.

2.5 ANCHORS AND FASTENERS

Each equipment manufacturer shall furnish the required anchor bolts, nuts and washers of adequate design for securing bases and bedplates to concrete bases. Provide anchor bolts of length to allow for 1-1/2 inch of grout under baseplates and adequate anchorage into structural concrete unless otherwise shown or specified. The manufacturer shall submit to the Engineer design calculations regarding recommended sizing and type of anchor bolts, nuts, and washers for securing the equipment, in accordance with the project seismic requirements.

Anchor and assembly bolts and nuts shall be of ample size and strength for the purpose intended. All nuts, bolts and washers shall be Type 316 stainless steel. All leveling nuts shall be Type 316 stainless steel.

All motor-driven equipment shall be furnished with cast-in-place anchor bolts or drilled-in anchors set with epoxy adhesive. Do not provide expansion type anchors for motor-driven equipment, or equipment or piping subject to vibration.

Expansion type anchors are not to be used for any submerged applications unless specifically noted on the Plans.

Anchor all non-motor-driven equipment with cast-in-place anchor bolts or drilled-in anchors set with epoxy adhesive except that, where specifically allowed by note on the Plans, expansion type anchors may be used.

2.6 SAFETY GUARDS

Cover belt or chain drives, fan blades, couplings, exposed shafts and other moving or rotating parts on all sides with safety guards conforming to all applicable Federal, State, and local codes and regulations; conform to the most restrictive requirement. Design guards for easy installation and removal, complete with necessary supports, accessories, and fasteners, all hot-dip galvanized. Design guards in outdoor locations to prevent entrance of rain and dripping water. Provide tachometer test opening in line with ends of shafts. Typically, guards shall be expanded metal on a structural steel frame except that outdoor guards may be of solid material. Provide spring loaded hinged doors with latch for service and lubrication access.

All pipes, manifolds, heaters, and other surfaces, which have a surface temperature sufficient to burn human tissue, shall be covered with a thermal insulating material or otherwise guarded against contact.

Guards shall comply with the requirements of these Specifications, WISHA Standards, and "The Principles and Techniques of Mechanical Guarding" (OSHA 2057, 1973), whichever is more stringent.

2.7 LIFTING EYES

All equipment weighing over 100 pounds shall be supplied with lifting eyes. Parts of equipment assemblies, which are normally serviced separately, such as motors, shall have individual lifting eyes.

2.8 ELECTRICAL COMPONENTS

Equipment shall be manufactured, fabricated and installed in a manner which permits conduit connection to electrical power and control equipment from below the connection point, terminal box, or connection box without offsets or bends such that the conduit will drain away from the equipment.

Electric motors, control panels, accessories, etc., shall conform to the requirements of Divisions 11, 12, 13, 14, 15 (Equipment items) and Division 16, Electrical.

If any motor fails during the warranty period, the Contractor shall replace the motor with a new motor. Rewinding a failed motor shall not be acceptable.

All electrical components shall be recognized or labeled and listed by a recognized electrical testing laboratory for the application, or approved by the Washington State Department of Labor and Industries for installation on the Project.

2.9 MOTOR PROTECTIVE DEVICE COORDINATION AND DOCUMENTATION

The Contractor shall maintain a spreadsheet or database list of the motor characteristics that are necessary to size, select, and/or set the various motor protective devices, such as thermal overloads, breaker trip devices, motor protection relays, etc. This list shall also include any additional information needed to set-up, program or adjust the variable frequency drive which serves motor driven equipment such as minimum speed, acceleration, etc. The list shall be sent with each equipment submittal for motor driven equipment and shall be updated to reflect the motor information for the submitted equipment

The Contractor shall record the size and/or settings of each motor protective device at the time of startup and after any subsequent adjustments on the motor characteristics list described in the preceding paragraph.

In addition, the Contractor shall take a digital photo of each motor nameplate when the motor arrives at the jobsite. Each digital photo shall be emailed to the Engineer, noting any discrepancy between the motor nameplate data and the submitted motor data.

2.10 NAMEPLATES/DATA PLATES/IDENTIFICATION

Each piece of equipment and its driver shall be furnished with a stainless steel metal nameplate fastened to the item in an accessible position. This nameplate shall contain the manufacturer's name, equipment rating, capacity, size, model, serial number and speed. Data for motors shall be NEMA standard. All information written or printed shall be in English. Each item of equipment shall bear a different serial number. Measurement units shall be given for ratings and capacity.

Nameplates for tanks and pressure vessels shall give working pressure, test pressure, vessel plate thickness and ASME Code data.

Each piece of rotating equipment shall have a direction of rotation arrow.

Each piece of equipment shall be labeled using a plastic laminate label with the functional name and number of the equipment shown on the Plans or provided by the Engineer. Name and number shall correspond to those used on Motor Control Centers and Panels.

Labels shall be fastened to the equipment base or other acceptable location. The letters shall be at least 1/2-inch high with a border trim on all sides not less than 1/4-inch. Color shall be green background with white letters. Fasteners shall be

brass or stainless steel screwed into inserts, anchor shields or tapped holes in equipment or base.

Units of measure shall be shown on the indicating and totalizing dials of all meters, gauges and other measuring devices.

2.11 PROTECTION AGAINST ELECTROLYSIS

Where dissimilar metals are used in conjunction with each other, suitable insulation shall be provided between adjacent surfaces so as to eliminate direct contact and any resultant electrolysis. The insulation shall be bituminous impregnated felt, heavy bituminous coatings, non-metallic separators or washers. Connections of dissimilar piping materials shall utilize dielectric unions, flanges, couplings or bushings.

2.12 PAINTING

Painting of all equipment shall be in accordance with Section 09900 of these Specifications.

2.13 NOISE

Mechanical and electrical equipment shall not create sound levels that are in excess of that permitted by WISHA for 8 hours per day worker exposure unless otherwise noted for the specific piece of equipment involved.

2.14 VIBRATION AND CRITICAL SPEED LIMITATIONS

Mechanical and electrical equipment shall meet the vibration and critical speed limitation requirements described in Section 11010.

2.15 PRESSURE GAUGE CONNECTIONS

Provide tapped and plugged suction and discharge gauge connections on the pump nozzles or flanges. Where this is not possible, provide gauge connections on the piping immediately adjacent to the pump.

2.16 PUMP SEAL WATER

The Plans show a seal water system applicable to some pump installations. The Contractor shall review each pump installation with the pump manufacturer and shall provide seal water installations in strict accordance with the manufacturer's recommendations at no additional cost to the Owner.

PART 3 EXECUTION

3.1 INSPECTION

Inspect each item of equipment for damage, defects, completeness, and correct operation before installing. Inspect previously installed related work and verify that it is ready for new equipment installation.

3.2 PREPARATION

Prior to installing equipment, ensure that the areas are clean and that concrete or masonry operations are completed. Maintain the areas in a broom-clean condition during installation operations. Clean, condition, and service the equipment in accordance with the Operation and Maintenance Instruction Manuals and specific requirements included in applicable Sections of these Specifications.

3.3 SPARE AND LOOSE PARTS

Prior to equipment startup provide an inventory of spare and loose parts supplied under the project. Turn over inventory and parts to the Owner. The Owner's written acknowledgment of receipt is required for project completion. Loose parts are defined as items such as special tools, keys, safety equipment, and portable equipment.

3.4 INSTALLATION

A. EQUIPMENT

Equipment shall conform to the approved submittals and Operation and Maintenance Instruction Manuals. Employ skilled craftsmen experienced in installation of the types of equipment specified. Use specialized tools and equipment, such as precision machinist levels, dial indicators, gauges, and micrometers, as applicable. Produce acceptable installations free of vibration or other defects.

B. ANCHOR BOLTS

Deliver bolts with templates or setting drawings and verify that bolts are correctly located before structural concrete is placed. Prior to assembly, the Contractor shall coat all stainless steel bolts and nut threads with anti-seizing compound.

C. BASE AND BEDPLATE GROUTING

Do not place grout until initial fitting and alignment of connected piping is completed. Level and align equipment on the concrete foundations, then entirely fill the space under base or bedplates with grout. Bevel exposed grout at 45-degree angle, except around exposed grout at horizontal surfaces for drainage. Trowel or point exposed grout to a smooth, dense finish and damp cure with burlap for 3 consecutive days. When grout is fully hardened, remove jacking screws and tighten nuts on anchor bolts. Check the installation for alignment and level, and perform corrective work as required to conform to the tolerances given in the applicable Operation and Maintenance Instruction Manual.

The Contractor shall make an allowance of at least 1-1/2 inches for grout under the equipment bases, whether or not shown on the Plans. Shims used to level and adjust the bases shall be steel. Shims may be left embedded in the grout, in which case they shall be installed neatly and so as to be as inconspicuous as possible in the complete work. Unless otherwise authorized, all grout shall be a non-shrink, non-metallic grout as stated in Section 03300.

Where practicable, the grout shall be placed through the grout holes in the equipment base and worked outward and under the edges of the base and across the rough top of the concrete foundation to a peripheral form so constructed as to provide a suitable chamfer around the top edge of the finished foundation.

D. PRESSURE GAUGES

Pressure gauges shall be installed on all pump discharge piping at a location where the gauges can be easily read. The gauges shall be located upstream of the isolation valves, if possible. Gauges shall be installed on other equipment items as specified. The gauges are specified in Division 13 and shall be installed as detailed on the Plans.

3.5 EQUIPMENT STARTUP AND ADJUSTMENT

The Contractor, at their own expense, shall arrange for an authorized factory-trained representative of the company or companies supplying the various items of equipment to:

- Supervise the equipment installation in accordance with the Operation and Maintenance Instruction Manual.
- Be present when the equipment is first put into operation.

- Inspect, check, adjust as necessary, and approve the installation.
- Repeat the inspection, check and adjust until all trouble or defects are corrected and the equipment installation and operation are acceptable.
- Witness and supervise operational demonstrations and system validation tests to the extent specified.
- Prepare and submit the specified Manufacturer's Affidavit.

The representative shall be experienced and knowledgeable regarding the equipment being tested.

The Contractor shall give initial lubrication to all equipment in accordance with the manufacturer's recommendations.

The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

All equipment shall be field tested and demonstrated to the Engineer that proper operation and capacity have been fully complied with. For pumps, this shall include measurement of suction and discharge pressure at the pump and measurement of pumping rate by volumetric means, or through a suitably calibrated meter for two points on the performance curve. Current draw and voltage on the motor for each phase shall be measured for each pumping rate measurement. For two-speed pumps, such tests shall be conducted at both speeds. For variable speed pumps, blowers or fans, these tests shall be conducted at minimum and maximum speeds and at the specified duty point.

The Contractor shall furnish and test equipment or measuring devices (including portable flow meters) required that are not part of the permanent installation. Tests for variable speed pumps, blowers, and other equipment shall be performed at 60 Hz and at the initial anticipated flow or capacity levels.

The field test shall demonstrate under all conditions of operation that the equipment:

- Has not been damaged by transportation or installation.
- Has been properly installed.
- Has no mechanical defects.

- Is in proper alignment.
- Has been properly connected.
- Is free of overheating of any parts.
- Is free of vibration in excess of the limits in Section 11010.
- Is free of excessive noise.
- Is free of overloading of any parts.
- Shall operate as specified with the specified control system.
- Is free of critical speeds as specified in Section 11010.

In addition, the entire facilities shall be demonstrated to be in full operating order prior to the acceptance of the work. Should any equipment or part thereof fail to operate as intended, it shall be immediately removed and replaced, all at the Contractor's expense.

Equipment start-up and adjustment shall take place before instruction of the Owner's personnel is performed.

3.6 INSTRUCTION OF OWNER'S PERSONNEL

Conduct an instruction program for up to six operations personnel designated by the Owner in accordance with Specification Section 01800. Furnish the services of qualified instructors from the various equipment manufacturers for the duration specified in each specific Section. Include instruction covering basic system operation theory, routine maintenance and repair, and "hands on" operation of equipment.

Provide the instruction program at the Owner's convenience before contract closeout. The Contractor shall audio- and video-record all training sessions, and also provide the Owner with any audio-visual training materials the manufacturer utilizes (i.e., DVDs, PowerPoint presentations, videocassettes etc.). Cost of instruction and audio-visual training materials shall be included in the bid price for the equipment.

3.7 SOUND LEVEL TESTING

Measure the sound level developed by all mechanical and electrical equipment provided under the Contract Provisions. Perform testing in all rooms and spaces containing such equipment during the final operation test program with all equipment operating. Use OSHA approved instruments and record the highest sound levels developed when measured according to OSHA standards in each room and space. Deliver a certified copy of records to the Engineer.

***** END OF SECTION *****

SECTION 11010

VIBRATION AND CRITICAL SPEED LIMITATIONS

PART 1 GENERAL

1.1 SCOPE

This Section specifies vibration and critical speed limitations for rotating mechanical equipment. Individual equipment specification sections may specify more stringent requirements, which shall then govern. Field-testing and vibration measurements shall be taken on all rotating mechanical equipment.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
11000	Equipment General Provisions

1.3 SUBMITTALS

Manufacturer's certified calculations and data showing location of critical speeds in relation to operating speeds shall be provided in accordance with Section 01300, when specified in the individual equipment specification sections. The package booster station pump skid design shall include vibration and critical speed limitation analysis.

Where equipment is driven with a motor powered with a variable-frequency drive, the Contractor shall provide information on the limits and ranges of the vibration, torsion, mechanical, thermal, and similar characteristics of the driven equipment, where such limits or ranges impact the speed, time, or ramp settings of the variable-frequency drive. These points and ranges shall be included as part of the submittal information for the driven item of equipment. The purpose of this requirement is to allow coordination of the variable-frequency drive configuration with the limitations of the driven equipment.

1.4 VIBRATION LIMITATIONS

Vibration frequencies shall span the range from 5.0 to 5,000 Hz. Where specified, measurements shall be obtained while the installed equipment is operating within the specified speed range. These measurements shall be recorded and provided to the Engineer along with the Manufacturer's Affidavits.

A. CENTRIFUGAL

1. Machines with Sleeve Bearings: Unless otherwise specified, centrifugal machines with sleeve bearing shafts shall not exhibit unfiltered Root Mean Square (RMS) readings for vibration displacement in excess of the following:

<u>Shaft speed range, rpm</u>	<u>Displacement, peak to peak, mils</u>
Up to 900	3.5
901 - 1800	3.0
1801 - 3000	2.5
3001 - 4500	2.0
Above 4500	1.6

Displacement measurements shall be taken radially on the shaft at two points at each bearing. Measuring points shall be 90 degrees apart.

2. Machines with Antifriction Bearings: Unless otherwise specified, centrifugal machines with antifriction bearing shafts shall not exhibit unfiltered RMS readings for vibration velocity in excess of 0.12 inches per second. Velocity measurements shall be taken on one point of each bearing housing.

B. POSITIVE DISPLACEMENT MACHINES

Unless otherwise specified, positive displacement machines of the rotary, reciprocating and controlled volume types shall operate without any lateral or torsional vibration characteristics that may accelerate wear of the equipment. The Contractor shall provide manufacturer's certification that the manufacturer has inspected the machine under operating conditions and found it to comply with the requirements of this paragraph.

1.5 CRITICAL SPEED REQUIREMENTS

Unless otherwise specified, rotating mechanical equipment shall not exhibit critical speeds within the specified range of operating speeds. Critical speeds for equipment with rigid rotor systems shall be at least 20 percent greater than maximum operating speed or impeller blade pass frequency, whichever is greater. Critical speeds for equipment with flexible shaft-rotor systems shall be at least 15 percent below minimum operating speed and 20 percent above maximum operating speed or impeller blade pass frequency, whichever is greater.

***** END OF SECTION *****

SECTION 11265

SKID-MOUNTED BOOSTER PUMP STATION

PART 1 GENERAL

1.1 SCOPE

The packaged pump station supplier shall provide a UL listed and NSF 61/372 certified, skid mounted, potable booster pump station complete with all components and functions as indicated on the contract drawings and as herein specified. It shall include end suction centrifugal pumps, with each pump operated by a variable frequency drive. The pump station shall be built to accept a future high flow pump.

The pump station shall be housed in a site-built pumphouse.

The pump station shall meet the performance requirements outlined in Part 2 - Products.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
09900	Painting
11000	General Requirements of Equipment
11010	Vibration and Critical Speed Limitations
Division 15	Mechanical
Division 16	Electrical

1.3 REFERENCE STANDARDS

NEMA – National Electrical Manufacturers Association

NEC – National Electrical Code

UL – Underwriters Laboratories, Inc.

AWWA – American Water Works Association

NSF/ANSI 61– Drinking Water System Components

ANSI – American National Standards Institute

ANSI/HI – American National Standards Institute/Hydraulic Institute

ASTM – American Society of Testing & Materials

1.4 QUALITY ASSURANCE:

The skid-mounted booster station shall be furnished by a single manufacturer who shall comply with the following:

A. SINGLE SOURCE RESPONSIBILITY

The single manufacturer supplying equipment to this specification shall furnish proof of a minimum of 15 similar installations and 10 years of experience manufacturing skid mounted booster stations as specified.

B. CERTIFICATIONS

The manufacturer shall be a UL Listed and NSF 61/372 certified Packaged Pump Station Manufacturer, a UL 508A Listed Control Panel Manufacturer.

C. MANUFACTURER PERSONNEL

The Manufacturer shall employ service personnel who are trained and certified in every aspect of service that may be required on the pump station.

D. APPROVED MANUFACTURER

The pumping system shall be manufactured by PumpTech, LLC of Bellevue, Washington or pre-approved equal. To be considered an equal manufacturer, proposed manufacturers shall submit and receive approval no less than 10 days prior to bid date.

1.5 SUBSTITUTIONS

Manufacturers other than that which is specified and/or not meeting all provisions of the specification shall be required to submit a complete and detailed PRE-QUALIFICATION PACKAGE to the engineer at least 10 days prior to the bid opening. Any PRE-QUALIFICATION PACKAGE must contain as a minimum:

A. Detailed Layout Drawings.

B. Detailed component specifications and catalog cut sheets for each component.

- C. Control and Instrumentation Diagram.
- D. Detailed list of variations required from original design, referencing appropriate sections of the specifications and locations on the drawings.
- E. History of the equipment offered, including similar installations elsewhere.
- F. All other data as required in Section 1.4 - Quality Assurance.
- G. A detailed System Performance Guarantee with appropriate remedies for Non-performance.

Manufacturers qualifying will be recognized by addendum a minimum of five (5) days prior to the bid opening. Contractors shall include all costs associated with any redesign required with their bid.

Manufacturers not meeting this specification or are not PRE-QUALIFIED and approved by the engineer as outlined above will not be considered for use on this project.

1.6 SUBMITTALS

Submittals shall be well organized, labeled, and presented in a professional manner. Sloppy or poorly presented submittals shall be rejected. The pump station manufacturer shall submit the following items as part of a complete submittal package:

- A. Shop Drawings
- B. Electrical Schematics
- C. Technical data sheets for all major system components, including: Pump performance curves and datasheets
- D. Control Panel Components: VFD, PLC, Touchscreen Interface, Panel Enclosure, & UL 508A Certification
- E. Powder coating
- F. Valves
- G. Instrumentation

1.7 SHOP DRAWINGS

Shop drawings shall be submitted showing sizes and arrangement of equipment, foundations, and anchor bolts required, performance characteristics, pump curves, control diagrams, wiring diagrams motor data sheets, methods of assembly, pipe hanging details, and connections to other work. Submittals shall be dated and signed as certified for use in construction of this Project. The arrangement of mechanical equipment and appurtenant piping shown on the Drawings may be varied as necessary to fit the approved certified manufacturer's installation drawings. However, the manufacturer's drawings shall not deviate from the Drawings and Specifications as to location, minimum clearances, size, type and design of equipment.

The following minimum requirements shall accompany all equipment submittals:

1. Overall dimensions.
2. Mounting arrangement and dimensions.
3. Description of materials.
4. Connection sizes and orientation.
5. Capacity and location of lifting eyes and/or fork-lift sleeves.
6. Motor arrangement and location of electrical connections.
7. Rating data – mechanical and electrical as applicable.
8. Detailed electrical wiring diagrams, showing component designation and rating.
9. Seismic calculations.
10. List of any special tools and/or spare parts required and to be furnished, if any.

Each piece of equipment, for which certified witnessed or non-witnessed performance tests are required, shall be accompanied by a completed form which will contain at least the following information:

1. Owner's name and location of project.
2. Contractor's name and subcontractor if applicable.
3. Name of item being submitted.
4. Specification reference by section, paragraph, and page.
5. Data on item (manufacturer, general descriptive data, dimensions, size of connections, speeds, performance curves, serial number).
6. Motor data, type, voltage, frequency, phase, full load, amperes, starting method, frame size, enclosure, insulation type, NEMA Code letter, dimensions, service factor, and serial number.

The Contractor shall ascertain the location of all pipe and motor connections in order to properly orient pipe penetrations and electrical conduits.

1.8 FACTORY TESTING

The pump station manufacturer shall conduct and document a complete factory dynamic test of the pump station prior to shipment. Pump station shall be tested throughout the entire operating range at the net discharge pressure called for in the technical specifications. Individual pump pressure, flow, RPMs, volts, amps, KW and power factor shall be documented for verification by the Owners' Representative prior to delivery upon request.

A. HYDROSTATIC TESTING

The packaged pump station shall undergo hydrostatic testing that meets ANSI/HI specifications and standards.

B. FLOW TESTING

The packaged pump station shall undergo Hydraulic Performance Acceptance testing that meets ANSI/HI 14.6 specifications and standards.

1.9 WARRANTY

The manufacturer shall warrant the equipment from defects and workmanship for a period of 2 years from substantial completion.

1.10 OPERATION AND MAINTENANCE MANUALS

An operation and maintenance manual shall be furnished at the time of start-up and initial training. The owner shall also receive training specific to the pump station. Operation and maintenance instructions shall contain the following as a minimum:

- A. Approved shop drawings and submittal data.
- B. Model, type, size and serial numbers of equipment furnished.
- C. Equipment and driver nameplate data.
- D. List of parts showing replacement numbers.
- E. Recommended list of spare parts.
- F. Complete operating instructions.
- G. Electrical schematics.

- H. Factory and start-up and test data, including pump curves.
- I. Service and Maintenance instructions.

1.11 COMPONENTS

The skid-mounted booster station package shall be supplied with the following minimum components:

<u>Equipment Name</u>	<u>Equipment Tag No.</u>
Booster Pump 1	01 BP 01
Booster Pump 2	01 BP 02
Magnetic Flow meter	01 FM 01
2-Inch Check Valve (Pump 1)	01 V 01
2-Inch Check Valve (Pump 2)	01 V 02
Pressure Relief Valve	01 PRV 01
Pressure Transducer	01 PT 01
Motor Control Panel	01 MCP 01
14-Gallon Hydropneumatic Tank	01 HT 01

In addition, each pump shall be provided with hose bibs, 2-inch butterfly valves, and pressure gauges on the suction and discharge piping, as well as all other appurtenances as indicated on the plans. The hydropneumatic tank shall be supplied by the booster station package manufacturer to be installed off-skid by the Contractor.

PART 2 PRODUCTS

2.1 DESIGN CRITERIA

All booster station components and coatings in substantial contact with potable water shall be of materials approved for potable water use through NSF 61/372. The entire booster station shall be certified NSF 61/372 compliant for potable water. Skids with individually certified NSF components will not be acceptable.

Furnish and install a skid-mounted booster station meeting the following design criteria:

System Type:	Potable Booster System
Site Conditions	
Electrical Input (V/Ø/Hz):	120 V/240 V/1 Phase/60 Hz
Inlet Pressure:	20 psi
Station Performance	
Design Performance @ Station Discharge:	52 gpm @ 62 psi Boost
Pump Design Criteria	
Type:	Vertical Multi-Stage
Motor Starting	6-Pulse Variable Frequency Drive
Motor Nameplate (HP/Enclosure):	3 hp/TEFC
Motor Nominal Speed	3,600 rpm
Design Performance:	52 gpm @ 144' TDH
Minimum Efficiency @ Design:	67%
Quantity:	2
Sequence of Operation:	Lead/Standby

2.2 BOOSTER PUMP OPERATIONS

The Lead Pump shall start when the system pressure drops below the system pressure setpoint. A variable frequency drive (VFD) shall vary the Lead pump speed as needed to maintain the system pressure setpoint. The Lead Pump shall enter sleep mode when the system setpoint is reached and demand stops, as indicated by either system flow or pump speed.

If the Lead Pump fails, the Lag pump shall take its place, assuming the previous designation of the failed pump.

The system shall alternate pump designations based on total operation time. Using the controller touchscreen, an operator shall be able to adjust the alternation time, as well as to manually alternate Lead Pump and Lag designations.

In the event that a pump is out of service or offline, whether for maintenance, because the HOA switch is in the “off” position, the thermal overloads are tripped, or for any other reason, the PLC will then try to start the standby pump.

Provide the following at a minimum:

Mechanical System Protections:

- Prime Loss
- Low Flow
- High Flow
- Low Level (Source Tank)
- Low Discharge Pressure
- High Discharge Pressure

Electrical System Protections:

- High or Low Voltage
- VFD Faults
- Motor Starter Failure
- Analog Transmitter Failure

2.3 PUMPS AND MOTORS

A. VERTICAL IN-LINE MULTI-STAGE CENTRIFUGAL PUMPS

1. Pumps shall be manufactured by Grundfos or preapproved equal.
2. The pumps shall be of the in-line vertical multi-stage design, ANSI/NSF 61 approved for drinking water.
3. The head-capacity curve shall have a steady rise in head from maximum to minimum flow within the preferred operating region. The shut-off head shall be a minimum of 20 percent higher than the head at the best efficiency point.
4. Suction and discharge ports for pressure measurement shall be provided.
5. All pump bearings shall be lubricated by the pumped liquid.
6. Pump Size and Range of Operation
 - a. Pump base shall require no more than 1.5 square feet of floor space (including motor).
 - b. The suction/discharge base shall have ANSI Class 250 raised face flange or internal pipe thread (NPT) connections as indicated in the drawings or pump schedule.

- c. Maximum working temperature shall be no less than 248 degrees F as standard.
- d. The maximum working pressure shall be 362 psig.

7. Standard Pump Materials

Parameter	Specification
Suction/discharge base, pump head, motor stool	Cast iron, A 48-30 B
Shaft	Stainless steel, AISI 316 or 431
Impellers, diffuser chambers, outer sleeve	Stainless steel, AISI 304
Impeller wear rings	Stainless steel, AISI 304
Shaft journals and chamber bearings	Silicon carbide
O-rings	EPDM or FKM

8. Pump Impeller Design

- a. Impellers shall be of the enclosed type with resistance spot-welded curved profiled blades and shall be secured directly to the pump shaft by means of a splined shaft arrangement.
- b. Impeller design characteristics shall be focused on achieving optimum pump hydraulic efficiency.
- c. The impeller stack shall have a modified design available for low NPSH inlet conditions.

9. Pump Thrust Compensation

- a. The axial thrust of the pump shaft during operation shall be compensated primarily by means of the drive motor fitted with angular contact bearings designed to handle the axial thrust load.

10. Pump Shaft Seal Design

- a. The shaft seal shall be of the cartridge type design.
- b. Standard shaft seal replacement shall be possible without removal of any pump components other than the coupling guard, shaft coupling and motor.

- c. Pump shall be available with options for double mechanical shaft seal or air-cooled seal chamber.

B. MOTORS

1. Standard motors shall to be provided with the following basic features:
 - a. Motors must be C or D-faced directly coupled to the pump.
 - b. Motors shall be designed for continuous duty operation, NEMA design A or B with a service factor rating no less than 1.15.
 - c. Totally Enclosed Fan Cooled Motors are to be furnished with class “F” insulation.
 - d. Motors shall be inverter duty rated.
 - e. Motor nameplate shall be mounted on enclosure with stainless steel fastening pins. Nameplate shall have, as a minimum, all information as described in NEMA Standard MG 1-20.40.1.
 - f. Motors over 50 lbs shall having lifting provisions to enable motor to be lifted from the pump end.

2.4 STATION BASE, PIPING, AND VALVES

A. PUMP STATION BASE

The system base frame shall be constructed of 3/8" steel plate per ASTM A36. The steel plate shall be press brake formed with a minimum riser height of 3 inches. Sub-structure supports shall be added as necessary using 3/8" steel strap. Welded bases or open rail systems shall not be acceptable. The base frame shall be 304 stainless steel.

B. PIPING, FITTINGS, & CONNECTIONS

All piping, fittings, and pipe supports shall be constructed of ASTM A53-B STEEL, Schedule 40, rated ANSI #150 or ANSI #300.

All welded flanges shall be Class D forged stainless-steel slip-on or weld neck type. All welded fittings shall be seamless, conforming to ASTM Specification A234, with pressure rating not less than 150 PSI.

All process piping shall be coated both internally and externally with NSF-61 rated thermosetting epoxy powder coating, with a thickness of no less than 10 mils or 316 stainless steel.

C. VALVES

1. Butterfly Style Isolation Valves

- a. The valve body shall be Cast Iron ASTM A126 Class B. The valve seat shall be EPDM rubber. Flange locating holes that meet ANSI Class 125/150. The valve shall have a through-stem direct drive double “D” design, requiring no disc screws or pins to connect stem to disc with no possible leak paths in disc/stem connection. The stem shall be mechanically retained in body neck and no part of stem or body shall be exposed to line media.
- b. Valve shall have a tongue-and-groove seat design, with primary hub seal and a molded O-ring suitable for weld-neck and slip-on flanges. Seat shall totally encapsulate the body, with no flange gaskets required. The disc edge and hub shall be spherically machined and hand polished for minimum torque and maximum sealing capability. The valve shall be equipped with non-corrosive bushing and self-adjusting stem seal. Valves shall be bi-directional and tested to 110% of full rating. Bi-directional pressure ratings shall be 175 Psi for 2 inches – 12-inch valves, and 150 Psi for 14 inches – 20-inch valves. No field adjustment necessary to maintain optimum field performance.
- c. Butterfly valves furnished under this section shall be NSF/ANSI 61 approved for potable water applications.
- d. The valves shall be Bray Series 30/31, or equal.

2. Check Valves

A spring-loaded non-slam type check valve shall be installed on the discharge of each pump. The valve shall be wafer style typed fitted between two flanges. The head loss through the check valve shall not exceed 5 PSI at the pump design capacity. Check valves shall be NSF/ANSI 61 approved for potable water applications. Check valves shall be Flomatic 888VFD series or approved equal.

3. Air Relief Valves

The pump station shall include continuous acting air relief valves on the discharge header located as shown on the technical drawing. The air relief valve shall continuously discharge entrapped air in the system and shall be constructed of a cast iron body with stainless steel float and trim. The discharge shall be piped to the floor drain. Air Relief Valves shall be NSF/ANSI 61 approved for potable water applications. Air relief valves shall be manufactured by Val-Matic or approved equal. The air relief valve shall be shipped loose for field installation.

4. Pressure Relief Valve

The pressure relief valve shall be located as shown on the technical drawing. The valve shall protect the piping network by bypassing or relieving excess pressure and shall maintain close pressure limits without causing surges. If upstream pressure decreases below the spring setting, the valve shall close. The valve shall be a Cla-Val Co. Model No. 50-01/650-01 Pressure Relief and Pressure Sustaining Valve as manufactured by Cla-Val, or approved equal.

2.5 INSTRUMENTATION

A. PRESSURE GAUGES

Bourdon tube pressure gauges shall be located on the suction and discharge manifolds. They shall be liquid filled with a 304 stainless steel case and bezel. Gauges shall be 2.5 inch diameter, with a 1/4-inch NPT pressure sensing connection.

B. PRESSURE TRANSMITTERS

The station shall have pressure transmitters located as shown in the technical drawing. The pressure transmitters shall provide noise free, linear output that is proportional to pressure. Transmitter shall be solid-

state, strain gauge type with integral voltage regulation and output accuracy not less than 0.4%. Transmitter shall be constructed of stainless steel and rated for the pump station discharge pressure called out in the technical specifications. Transmitter shall have a 4-digit LED alphanumeric display. The pressure transmitter shall be manufactured by Wika, Dwyer or approved equal.

C. ELECTROMAGNETIC FLOW METER

1. The pump station shall have a flow meter installed as shown on the technical drawing, installed according to manufacturer's recommendations.
2. The flow meter shall be NSF-61 rated for potable water applications.
3. The flow meter shall be electromagnetic design comprising of two major components, a primary head and a signal converter. The primary meter head shall incorporate a straight-thru flow design with no moving parts or pressure loss.
4. The flow meter signal converter shall produce two separate signals, totalizing pulse and 4-20ma, in linear proportion to flow rate. Flow data, including flow rates and flow totals, shall be accessible via the door-mounted PLC touchscreen interface.
5. Flow meter shall read flows from 0.10 - 39 FT/S, with an accuracy of +/- 0.25%. Flow meter shall be sized so that maximum system flow lies between 16 and 24 FT/S through the meter. The flow meter shall be shipped loose for field installation.
6. The meter shall be fully tested during the pump station full run performance testing while at the factory prior to shipment. The magnetic flow meter on the pump station shall be calibrated against a master meter.
7. The flow meter shall be Badger Meter M2000 series or equal.

2.6 MOTOR CONTROL PANEL (MCP)

A. GENERAL

1. The Motor Control Panel shall incorporate all circuits and necessary protections required to operate the pump station,

including motors, controls, and internal heating and ventilation circuits. All wiring shall conform to NEC and UL 508A standards.

2. The panel shall be designed, built, tested, and UL 508A listed by the pump station manufacturer. The control panel shall be UL labeled as an "Enclosed Industrial Control Panel." The pump control panel shall be completely manufactured, tested and programmed prior to delivery to the job site.
3. Electrical connection, by purchaser, shall consist of a single conduit from owners panelboard to the pump station main disconnect. Owner's circuit to MCP shall be a 240 V, single phase, 70 A circuit with neutral for 120 V loads.
4. The following shall be permanently affixed to the inside of the control panel enclosure:
 - a. A full-color, diagrammatic wiring schematic.
 - b. Pump and motor nameplate information.
 - c. Factory calibrated control setpoints.

B. PANEL CONSTRUCTION

The pumping station electrical controls, including variable frequency drives and operator interface, shall be housed in a NEMA 12 enclosure.

1. The enclosure shall be fabricated from carbon steel, 12 gauge minimum, coated inside and out with ANSI-61 gray powder coating.
2. All internal components of the enclosure shall be mounted on a removable sub-panel, which shall be powder coated white. Mounting screws for components shall not be tapped into the enclosure wall.
3. The electrical panel doors shall be removable and interchangeable, with concealed hinges and integral latches. Door gasket seals shall be oil-resistant, and shall be sufficient to protect interior components from weather and dust.
4. All external operating devices shall be dustproof and weatherproof.

5. No pressure gauges, pressure switches, water activated devices, or water lines of any sort shall be installed in the control panel.

C. MCP TEMPERATURE REGULATION

The cooling system shall be sized for local maximum ambient conditions, plus component cooling requirements. Cooling should be designed such that the internal panel temperature does not exceed 104F.

D. MAIN DISCONNECT

A two-pole, main circuit breaker disconnect shall be contained within the control enclosure. The main disconnect shall isolate all power to the enclosure. The main disconnect shall have an operating handle mounted in the enclosure door, mechanically interlocked to prevent entry while disconnect is in the ON position.

E. PILOT DEVICES

1. The control panel shall include the following pilot devices:
 - a. 3-Position Selector (HOA) Switches
 - b. Speed Potentiometer
 - c. Pilot Lights (shall be LED push-to-test): A red light shall indicate system faults; a green light shall indicate pump is running.
2. VFD Status Indicator: Internal parameters of critical system operations must be viewable without opening the enclosure door. This shall be provided by either door mounted VFD interface modules, 1 per drive; or integrated into the Operator Interface display specified below.

F. SECONDARY CIRCUIT BREAKERS

Secondary distribution breakers with appropriate ratings shall supply power to each pump starter and control system circuit.

G. SURGE PROTECTION

The control panel shall include an industrial surge protector UL 1449 latest edition rated.

H. VARIABLE FREQUENCY DRIVES (VFDS)

1. The control panel shall be equipped with variable frequency drives (VFD) on all pumps & motors. 6 pulse minimum VFD shall be isolated from main input power by use of a contactor to protect the VFD from power outside of tolerances.
2. The variable frequency drive shall be IGBT based with selectable carrier frequency up to 15 KHZ. The VFD shall include terminals for incoming power, motor output power and control terminals. All VFDs shall include an RS485 or ethernet port built-in to the VFD for dedicated communication to the PLC.
3. The VFD shall generate a sine-coded, variable voltage/ frequency, three phase output for optimum speed control. The VFD shall incorporate power loss ride-through for a minimum of 2 seconds. VFD protective features shall include current limit, auto restart, short circuit protection, electronic motor overload protection, and ground fault protection. The VFD shall have a push button programming display for easy access to operation parameters. The VFD shall be protected on the primary side by a breaker of the appropriate amperage.
 - a. Overload capacity: 120% rated output current for one minute.
 - b. Voltage fluctuation: +10%, -15%.
 - c. Sine wave, PWM, with full range, and automatic torque boost.
 - d. Frequency control range: 0 - 80 Hz.
 - e. Frequency accuracy: digital, 0.01 Hz, analog, .1%. Motor overload protection, instantaneous over current of 180% of rated output current.
 - f. Over voltage.
 - g. Under voltage shall be user-adjustable.
 - h. Momentary power loss: up to 2 second ride through.
 - i. Electronic ground fault.

- j. Led capacitor charge indicator.
 - k. Input phase loss alarm.
 - l. Ambient temperature range of 0 to 50 degrees C.
 - m. Humidity of 95% non- condensing.
 - n. Manufacturer: ABB ACS550 Series, ABB ACS580 Series, Mitsubishi F800 series, Schneider Altivar ATV630 series, or approved equal.
4. VFDs shall be provided with line and load reactors or DC chokes. Filters integral to the drive shall be acceptable.

2.7 PUMP SYSTEM CONTROLLER

A. GENERAL REQUIREMENTS

1. Non-Proprietary, Open Source Programming

To better facilitate system SCADA integration, as well as owner access to system servicing, the control system shall be non-proprietary and open-source, with the complete system programming made available to the owner via USB drive. Proprietary control systems shall not be accepted.

2. Controller User Guide

The pump station manufacturer shall supply an owner's manual in digital form that includes graphic images of all touch screens, complete with explanations of all settings and modes.

3. Remote Monitoring and Control

The control system shall be Ethernet based to enable remote system monitoring and control via wireless modem or other internet service.

4. Media Conversion

The control system shall contain a media converter directly compatible with an Allen-Bradley Ethernet/IP protocol such that the connection mentioned in "3. Remote Monitoring and Control", is made over a pair of SC OM2 fiber optic ports. Provide an

unmanaged CAT 5/6 to fiber optic converter internal to the pump system controller package. Fiber optic ethernet ports from a PLC comm card shall also be acceptable.

B. PROGRAMMABLE LOGIC CONTROLLER (PLC)

The PLC and modules shall be manufactured by Allen-Bradley, IDEC, or equal.

C. OPERATOR INTERFACE

The operator interface shall be an LCD color touchscreen, with a minimum diagonal length of 5.7". The touchscreen shall allow operator access to all system settings and monitoring data. The touchscreen shall be mounted to the motor control panel door. The operator interface shall be manufactured by Allen-Bradley, IDEC, or equal.

D. MONITORING FUNCTIONS

1. System Overview Screen

- a. Pump status, including lead pump designation, VFD frequency, and current draw.
- b. Alarm conditions, with the ability to manually reset alarms.
- c. Current values of all system sensors, including pressure and flow and reservoir level.

2. Fault Log

- a. The controller shall have a system fault log that displays the precise times of fault occurrences and recoveries, as well as message indicating the fault type. The fault log shall include a fault diagnosis utility that provides possible causes of and solutions to all system faults and warnings.

3. Trend Log

- a. Trend graphing screen capable of detailing pressure, flow, and current data. Graphing function shall give the option to graph and plot a point at user adjustable intervals. All data shall be capable of being downloaded to a USB drive, and allow an operator to upload the data to a spreadsheet type program.

E. CONTROL FUNCTIONS

1. Pressure Settings

Pressure transmitter calibration, discharge pressure setpoint, and high- and low-pressure alarm/fault conditions.

2. Flow Settings

Low and high flow alarm conditions, flow meter sensor calibration settings, and total gallons pumped with user reset button and time/date stamp of last reset.

3. Level Settings

Low- and high-level alarm conditions, level transmitter calibration settings, and optional level PID pressure setpoint manipulation.

4. Pump Settings

Pump detail screens showing total run hours of each pump since last reset and any modes, options, or functions specific to that pump.

5. Pump Sleep Settings

The pump shall enter sleep mode via user adjustable settings based on either of two thresholds: VFD frequency or system flow. The user shall also be able to adjust the sleep delay mode. The pump shall enter operating mode when the system pressure reaches a user adjustable “Wake-Up” pressure setting.

6. Pre-programmed Startup Routines

- a. The PLC shall be programmed with various start-up routines that limit and/or delay the starting and acceleration of the pump—ensuring that excessive velocity and pressure do not damage the distribution system.
- b. The program shall include individual routines for initial startup, mainline fill, restart after a power outage, and restart after a system fault.

- c. The operator shall be able to adjust the timing of the routines via the operator interface.

7. Password Protection

8. Loading and Saving System Default Settings

The system shall allow the operator to Load Factory Default PLC settings, Save New Operator settings, and Load previously saved Operator PLC settings.

9. System Data and Time

The PLC shall allow the operator to change the system date and time.

10. System Protections

- a. Controls shall shut down the pump station in the event of the alarm conditions described in this section, as well as otherwise indicated. The system controls shall attempt to restart the system after alarm shutdown or loss of power. After a user-adjustable number of attempts to re-pressurize the system, the controls shall go into hard shut down and remain so until manually reset.
- b. Low Flow Shutdown. The PLC shall automatically shut down the system if there is no, or too little flow, based on signals received from the flow meter. The low flow shutdown shall have a user adjustable time delay.
- c. High Pressure Shutdown. In addition to the pressure data received from the pressure transmitter, the PLC shall automatically shut-down the system based on (an adjustable) high pressure level received from the pressure transmitter.
- d. Low Level Shutdown. The controller shall automatically shut-down the system based on low level signals from the reservoir level transmitter. Transmitter is provided by others connected to the I/O terminals described further below in this specification.

- e. Electrical Fault Shutdowns. Incoming power high, and low limits. Shut-down and restart time delays shall be user-adjustable.
 - f. Analog Transmitter Failure. Input levels of all connected transmitters and meters shall be monitored for failures.
 - g. Motor starter failure. Circuit breaker and/or motor overload contacts shall be monitored to indicate a motor failure.
 - h. VFD Faults.
11. I/O terminals
- a. The controller shall be provided with terminals to accept the following hardwired discrete inputs. The majority of these signals are “pass through” signals, being brought in as hardwired and converted to Ethernet IP over fiber, but not necessarily required to be used in the booster skid process.
 - i. Flow meter totalizing pulse
 - ii. Reservoir High-Level Alarm
 - iii. ATS in generator position
 - iv. Generator warning
 - v. Generator alarm
 - vi. 3 spare sets of terminals
 - b. The controller shall be provided with analog input terminals for the following:
 - i. A loop powered, 4-20mA signal from the reservoir’s level transducer. (Transducer provided by others.)
 - ii. Flow from the flow meter associated with the skid.

- c. All analog and discrete inputs listed above shall be converted to Ethernet/IP as previously described. In addition, the skid manufacturer shall program the controller to provide the following additional networked outputs.
 - i. Booster skid minor alarm: The conditions determining this are left to the skid manufacturer. They are alarms which do not require immediate onsite attention.
 - ii. Booster skid major alarm: The conditions determining this are left to the skid manufacturer. They are alarms which require immediate onsite attention.

2.8 PAINTING

Nameplates, drain holes, vent openings, and lubrication fittings shall not be painted. Piping shall be painted per Specification Section 09900.

2.9 DISINFECTION

Contractor to disinfect and test new piping, valves, and fittings as outlined in AWWA C-651-14 and Section 02500.

2.10 SPARE PARTS

One set of manufacturer's spare pump parts shall be provided in labeled, wood boxes, with moisture protection and contents labeled for each pump. The following spare parts shall be provided and stored in protective containers.

Gaskets	1 set
Mechanical seal	1 each
Stack Kit	1 each

PART 3 EXECUTION

3.1 PREASSEMBLY

The skid mounted booster station will be entirely factory preassembled with all components integral to the mounting skid. Installation requirements will include proper location and anchorage of the unit on the jobsite base pad, and completion of electrical and piping connections to and from the unit. Anchorage and all connections to piping shall be made as indicated on the drawings.

3.2 DELIVERY OF EQUIPMENT

Equipment supplied under this section shall not be delivered to the site until construction has progressed to the point where installation may properly commence.

3.3 INSTALLATION

- A. The Skid Mounted Booster System shall be installed as shown on the Contract Drawings and specified herein.
- B. The skid shall be set on an asphaltic mastic compound on the concrete equipment pad. The skid shall be anchored to the equipment pad per the manufacturer's recommendations.
- C. The Manufacturer shall inspect the installation of all equipment in this section prior to start-up in order to verify that the equipment has been properly installed and operates properly as a system.
- D. The Manufacturer after the equipment has been properly installed shall calibrate the equipment with the Owner's operator present.
- E. The Manufacturer shall pre-run power and control connections between the motor control panel and motors mounted on the skid assembly.

3.4 ONSITE PUMP STATION STARTUP

Technical startup shall be furnished by the Packaged Pump Station Manufacturer or a qualified service agent. Location and mounting details shall be furnished by the Packaged Pump Station Manufacturer.

The services of a factory-trained representative of the pump manufacturer shall be provided by the Contractor. Services shall include 3 days (two visits) onsite for the supervision of equipment startup, testing, and instruction of the Owner's personnel in the operation and maintenance of the equipment. One visit shall be for installation inspection, certification, testing and startup; and one visit shall be for training. Instruction and training of the Owner's personnel shall not take place until startup is completed and the pumps are fully operational. The training shall be at a time and location agreed to by the Owner.

The representative shall provide for two additional service calls during the initial 2 years of equipment operation.

Technical startup procedures by the pump station technician shall include the following:

1. Station start-up and pressurization.
2. Pressure, flow, and programming adjustments.
3. Monitoring of complete operational cycle when possible.
4. Testing of all alarms and fault conditions.
5. Customer training and the presentation of the station operation and maintenance manual.

***** END OF SECTION *****

DIVISION 13
SPECIAL CONSTRUCTION

SECTION 13212

CONCRETE RESERVOIR

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the furnishing of all materials, labor, and equipment for the construction of a concrete water storage reservoir with concrete cover and interior supports as required.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
02510	Testing and Disinfection
03200	Concrete Reinforcement
03300	Cast-in-Place Concrete
Division 5	Metals
08310	Metal Access Hatches

1.3 SUBMITTALS

Submit under provisions of Section 01300.

A. CONCRETE

For concrete products, comply with Section 03300.

B. SHOP DRAWINGS

1. Plans and/or elevations locating and defining all material furnished by manufacturer, including dimensions and finishes.
2. Sections and details showing connections, cast-in items and their relation to the structure.
3. Sections and details to indicate quantities and position of reinforcing steel, anchors, inserts, etc.
4. Description of all loose, cast-in and field hardware.

C. RESERVOIR DESIGN CRITERIA

1. Loadings for Design
 - a. All dead and live loads as specified.
 - b. All other loads specified for member, where applicable.
2. Reservoir design calculations shall be performed and stamped by a structural engineer registered in the State of Washington experienced in the work under this Section.

1.4 DESIGN REQUIREMENTS

Design, fabricate, erect, inspect, and test in accordance with the 2015 International Building Code (IBC), except as modified herein.

Railings and ladders shall be designed in conformance with applicable safety and building codes, including OSHA, WISHA and the IBC.

Capacity: 87,000 U.S. gallon

Diameter: 20'- 0"

Reservoir Shell Height: 37'-0"

Minimum Wall Thickness: 15"

Vertical Loads

Dead Load: Actual

Roof Live Load: 20 psf

Snow Live Load: As required by local jurisdiction

Water Live Load: 62.4 pcf

Platform and Landings

Live Load: 150 psf

Design earthquake load in accordance with ASCE 7-10 Section 15.7.6. "Ground-Supported Storage Tanks for Liquids."

A. LATERAL FORCES

1. For wind loading conditions, the overall stability of the reservoir shall be designed to resist forces generated by the requirements for wind per ASCE 7-16.

2. Wind

Ultimate Wind Speed = 110 mph, 3-second gust

3. Seismic

Evaluate the seismic loads according to ASCE 7-16 with the following parameters:

$$S_s = 1.599g$$

$$S_1 = 0.581g$$

$$I = 1.5$$

$$S_{DS} = 1.247g$$

$$S_{D1} = 0.666g$$

B. SOIL BEARING PRESSURE

Soil bearing pressure has been determined to be 2,000 psf.

1.5 QUALITY ASSURANCE

The concrete tank suppliers shall have furnished and erected at least ten similar concrete tanks within the last 5 years of at least 250,000 gallons in capacity. A letter shall be submitted by the apparent low bidder within 48 hours after the bid opening listing ten such tanks, including name of owner, capacity, location, year completed, and telephone number of owner or owner's consultant.

1.6 GUARANTEE

The Contractor shall guarantee the complete tank and all items related thereto against defective materials and workmanship for a period of 2 years after date of acceptance by the Owner. Any defective materials or workmanship shall be replaced by the Contractor, at his/her expense, immediately upon notification by the Owner.

PART 2 PRODUCTS

A. APPROVED MANUFACTURER

The concrete reservoir shall be manufactured by Mt. Baker Silo of Lynden, WA, or pre-approved equal. To be considered an equal manufacturer, proposed manufacturers shall submit and receive approval no less than 10 days prior to bid date.

B. CONCRETE

All concrete products shall comply with Section 03300.

C. REINFORCING STEEL

Reinforcing steel shall comply with Section 03200.

D. WATERSTOPS

Provide waterstops in construction joints of all water containment structures and where shown on the Plans. Install waterstops to form continuous diaphragm in each joint in accordance with manufacturer's recommendations. Make provisions to support and protect exposed waterstops during progress of work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions and recommendations. All waterstops shall be tied into place using hog rings and/or tie wire to keep the waterstop from moving during placement of concrete. Provide manufacturer's written warranty for all waterstop installations.

E. ACCESSORIES

Provide the following accessories:

1. Ladders

Provide inside and outside ladders at the locations shown on the Plans. Ladders shall be hot-dip galvanized after fabrication. The ladders and landings shall be designed to be in compliance with WAC 296-24. Ladders shall be furnished with fall restraint system, Saf-T-Climb or equal. Two safety harnesses shall be provided with the fall restraint system.

2. Hand Railing

Provide hand railing on reservoir roof as shown on the Plans, and as specified in Section 05500.

3. Roof Hatch

Roof access hatch shall be ASTM A36 steel and hot-dip galvanized after fabrication. Access hatch shall be Halliday F1R series or equal. Hatch shall have 0.25-inch thick tread plate cover and frame extrusion, stainless steel hardware and hold open arm, hinged lockable protection, pressure locks, and an EPDM gasket cushion on the cover and under frame perimeter

4. Roof Vent

Provide one circular removable mushroom-shaped roof vent located at the center of the reservoir, as shown on the Plans as manufactured by Newlin, Inc. (Montezuma, Indiana ((765) 245-2741) or approved equal. The vent shall be of adequate size to handle pressure differential caused by water entering or leaving the tank at a maximum rate of 1,000 gpm with 30 percent of the vent screen blocked. The open area of the overflow shall not be considered as venting area. The Contractor shall provide a special screened vent to ensure fail-safe operation, in the event the screen frosts over or is otherwise clogged. The vent shall be easily dismantled to remove the screens for cleaning. The vent shall be screened with No. 24 mesh stainless steel screen and properly attached to prevent insects, water or other contaminants from entering.

5. Overflow

Provide an overflow as shown on the Plans.

6. Pipe Connections

Provide inlet, outlet, overflow, and drain connections, as shown on the Plans.

7. Water Level Indicator

Provide a water level indicator or "telltale" with a metal indicator board painted white with black numerals marked on even foot marks with numbers arranged from "0" to "Full Water" depth or

height. The numbers on the gauge board shall be approximately 6-inches high. The gauge board length shall be 1/2 the water depth. The necessary pulleys to obtain this 2:1 ratio (water depth to the indicator length) shall be located on the reservoir exterior. The operating cable shall be enclosed pipe with pulleys. The cable shall be 5/32-inch-diameter stainless steel.

F. PRODUCTS IN CONTACT WITH POTABLE WATER

All products in contact with potable water, including form release and curing compounds, shall be ANSI/NSF 61 certified for potable water use.

PART 3 EXECUTION

3.1 CONCRETE

All concrete products shall comply with Section 03300, except the following:

A. FINISHES

1. Surface Finishes

All finished or formed surfaces shall conform accurately to the shape, alignment, grades and sections as shown on the Plans. Surfaces shall be free from fins, bulges, ridges and offsets, honeycombing or roughness and shall present a finished continuous hard surface.

2. Wall Surfaces

Steel forms shall be used on all wall pours. Forms shall not leak excessive amounts of mortar or yield beyond specific tolerances when the concrete is vibrated. Rock pockets, honeycombed areas, form tie holes, and any holes over 1/2-inch deep shall be repaired. No sacking or hand-rubbing will be required on any concrete finishes.

Allowable tolerances for concrete surfaces shall be classified as "abrupt" and "gradual." Offsets caused by displaced or misplaced forms and form alignment shall be considered as abrupt irregularities. All others are classed as gradual irregularities. Allowable tolerances are the same for both slabs and walls, and are as follows:

a. Abrupt - 1/2"

b. Gradual - 1"

3. Base and Roof Surfaces

All slab finishes shall have a "non-slip broom" finish, to prevent slippery surfaces. The concrete "non-slip broom" finish shall be uniform in texture, relatively free from screed/float marks, and shall comply with Section 03300. The under side of the roof shall be a rough form finish as results from the use of plywood forms. Roof shall be a minimum slope of 1:12 after 30 days cure.

3.2 LADDERS

Install fall restraint system as shown on the Plans and in accordance with manufacturer's recommendations.

3.3 DISINFECTION AND TESTING

The reservoir shall be disinfected and tested after all interior accessories are in place. Methods and procedures for disinfecting the reservoir shall conform to AWWA C652, Disinfection of Water-Storage Facilities.

The use of chlorine solution (sodium hypochlorite) or dry chlorine (calcium hypochlorite) is anticipated as the active disinfecting agent. Contractor shall be responsible for safe and proper handling and storage of chlorine compounds or other hazardous chemical that are used to perform this work. Handling of such chemicals shall be in accordance with chemical manufacture's instructions and federal, state and local regulations. Other hazardous chemicals shall be used only after acceptance by the Engineer and Department of Health.

The intent of this section of the specifications is for the passage of bacterial and odor tests, protection of materials, health/safety and conservation of water. To achieve these requirements the Contractor shall submit written procedures and plans for disinfection of the reservoir and collecting samples to be tested by an independent laboratory. The submittal shall include:

1. Type of disinfection solution and method of preparation.
2. Method of disposal for disinfecting wastewater.

Before disinfecting, isolate the reservoir to prevent contamination of the distribution system. Remove all scaffolding, planks, tools, rags and other material not part of the structure or operating facilities of the reservoir. Clean the interior surfaces (walls, roof, beams and floor) with a pressure washer to remove dirt, oils and other foreign materials. Contractor shall be careful not to damage the

structure or the new coating system in preparing the reservoir for disinfection. Disposal of water used to clean the interior of the reservoir shall be done before disinfection in accordance with applicable regulations. All water, dirt and foreign material accumulated in this cleaning operation shall be discharged from the reservoir or otherwise removed. This foreign material may be discharged out the drain piping, but shall be captured in the drainage basin and disposed to waste.

Disinfect all interior surfaces of the reservoir in accordance with the following method:

Spray or brush a solution containing 200 ppm of available chlorine onto the interior surfaces of the reservoir as prescribed in AWWA C652 Method 2. Apply solution from the bottom up and to include the entire surface area of the reservoir. Allow to remain 30 minutes or until dry before being rinsed off. Drain, dechlorinate, and dispose of all cleaning water. Fill reservoir with potable water as specified in AWWA C652.

Prior to disinfecting the reservoir, the Contractor shall schedule with the Owner to collect and analyze water samples.

After the reservoir has been cleaned, disinfected and filled with potable water, the Owner will take water samples and have them analyzed for presence/absence of total coliform and offensive odors. Sampling requirements are as follows:

1. After 48 hours a minimum of two samples shall be obtained and analyzed by standard procedures outlined by state and local regulatory agencies after at least 10,000 gallons are allowed to flush from the reservoir.
2. Sampling points shall be representative.

If satisfactory results are shown in the presence/absence test for total coliform, then the reservoir may be placed in service. If unsatisfactory results are shown in the presence/absence test for total coliform, repeated sampling and testing shall be done until two consecutive samples are satisfactory or the reservoir shall again be subjected to disinfection.

Watertightness tests shall be made at the time that the reservoir is being disinfected after the concrete has obtained at least 90 percent of its required 28-day compressive strength, but in no case sooner than 20 days after placing. Watertightness tests shall consist of filling the tank to the overflow with potable water after plugging outlets as necessary and allowing the tank to remain full for 72 hours.

Maximum allowable water surface drop after correction for evaporation shall be 0.10 inch during the final 24 hours of the test.

Leakage testing shall not be conducted during periods of time with measurable precipitation. Evaporation correction shall be made on the basis of an evaporation pan.

Watertightness testing may follow backfill of the structure, at the Contractor's option. However, if the structure does not pass the test, re-excavation to locate leaks will be required.

If a joint is not watertight after construction, the Engineer will require the repair to be by epoxy adhesive injection. Adhesive shall be Concretive 1380/Structural Concrete Bonding Process, which is a product, and process of the Adhesive Engineering Company, or equal. Epoxy adhesive injection shall be performed in strict accordance with the manufacturer's Guideline Specification. Concrete bonding and adhesives used to assure water-tightness of the structures must be listed by NSF as conforming to Standards 60/61.

The Owner will provide the water to fill the reservoir one time. Any additional water required due to failure of the disinfection or leakage tests shall be paid by the Contractor.

***** END OF SECTION *****

SECTION 13419

PRESSURE TRANSMITTERS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing and installing a gauge pressure transmitter as specified herein and as shown on the Plans. The pressure transmitter shall be complete with all necessary accessories and hardware for a complete and workable installation.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning, and Training
11000	Equipment General Provisions
Division 16	Electrical

1.3 EQUIPMENT LIST

Equipment number is as follows:

<u>Item</u>	<u>Equipment Number</u>
Section Booster Pump Header	01 PT 01
Discharge Booster Pump Header	01 PT 02

1.4 PERFORMANCE REQUIREMENTS

The pressure transmitter shall be provided with the following pressure range for the specified applications and locations.

Parameter	Value
Reference Accuracy (percent of span)	0.065%
Long Term Stability (2 year max, percent)	0.1% of URL
Span Drift (percent)	None measurable
Turndown Capacity	100:1
Total Response Time	100 ms
Pressure Range	0 – 150 psig
Measurement Media	Potable Water
Maximum Media Temperature	100°F

If the manufacturer's rated maximum process temperature in the measuring cell is less than the Maximum Media Temperature listed above, the Contractor shall provide a process connection pipe/hose of sufficient length to provide ambient cooling so that the maximum measuring cell temperature is not exceeded.

1.5 WARRANTY

In addition to the warranty required in the General Conditions, the equipment manufacturer shall provide an extended warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

1.6 DELIVERY, STORAGE AND HANDLING

All equipment shall be completely factory assembled, crated and delivered to protect against damage during shipment.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The pressure transmitter shall be Emerson Rosemount Model 2051T, Siemens SITRANS P DS III, or Endress and Hauser Deltabar S PMD75, with a block and bleed valve manifold provided. No other manufacturers or models shall be accepted.

2.2 PRESSURE TRANSMITTER

The pressure transmitter shall be a digital transmitter with piezoresistive or capacitance-based sensor and Type 316 stainless steel diaphragm seal. The pressure sensitive element shall be Type 316 stainless steel, silicone oil filled, and shall be calibrated for the range as specified in the Performance Requirements.

The transmitter pressure sensor shall be protected from the effects of pressure swings and spikes up to the maximum working pressure (body rating) of the pressure capsule. The process connection shall be Type 316 stainless steel, ½-inch diameter, NPT 14 thread. The process connection shall be connected to a Type 316 stainless steel block-and-bleed manifold with a Type 316 stainless steel isolation valve and a bleed vent. The manifold shall permit removal of the sensor for maintenance or replacement with minimal leakage of process air during compression removal of the sensor.

The transmitter shall be a true two-wire loop-powered device, 24 VDC, without the requirement of a separate power supply at the transmitter. The unit shall be modular plug-in design.

The non-wetted transmitter housing shall be aluminum or stainless steel and shall meet NEMA 4X standards. The pressure transmitters shall display the measured pressure on the front of the unit enclosure and all units shall have a menu-driven keyboard on the front panel of the transmitter. The transmitter shall have an LCD display for indicating the pressure in real engineering units (psig). The display shall be rotatable in 90 degree increments. The unit shall be capable of recalibration in the field by the menu-driven keyboard. The keyboard shall allow for viewing control of results, the error messages, the operating modes, and the digital display.

The controller shall be supplied with one isolated 0/4-20 mA standard DC (direct current) analog output; with 0.004 mA (12-bit) resolution and capability to drive up to 500 Ω loads.

The digital information shall be evaluated in the microcontroller, its linearity and temperature response corrected and converted in a digital-to-analog converter into an analog output current.

The transmitter shall have the ability to electronically compensate for the effects of mounting position on the sensor. Furthermore, the transmitter shall be able to force the loop current to various values to aid in loop setup and testing.

The transmitter shall have online diagnostics and registers to detect and store various parameters such as min/max electronics temperature, min/max pressure, capsule temperature, and min/max process pressure to help diagnose process problems. The transmitter shall also have dual timer registers that allow the transmitter to signal when a settable time has elapsed for preventative maintenance or calibration.

Analog instruments shall operate without loss of loop accuracy due to electromagnetic interference, resistive or inductive losses or similar problems related to field interconnection of components when connected with shielded copper wire in the manner shown on the Plans.

The pressure transmitters shall be listed and labeled by an electrical testing laboratory recognized by the Washington State Department of Labor and Industries or be acceptable to the Washington State Department of Labor and Industries for installation on this project.

The pressure transmitter sleeve shall be of sufficient diameter to house the pressure transmitter.

2.3 SPARE PARTS

The manufacturer shall provide the manufacturer's recommended spare parts and special tools. All spare parts and tools shall be suitably identified and effectively protected from moisture and corrosion with appropriate wrappings or coatings or a combination thereof. All parts shall be furnished in sturdy labeled boxes.

2.4 FACTORY TESTING

The equipment shall be fully tested at the manufacturer's factory before shipment. Tests shall insure that the equipment will operate as desired under anticipated field conditions. Certified copies of test report(s) shall be submitted to the Engineer prior to shipment.

PART 3 EXECUTION

3.1 INSTALLATION

The pressure transmitters shall be installed at the locations shown on the Plans in accordance with manufacturer's recommendations.

All mounting hardware and supports shall be provided by the Contractor.

If the manufacturer's rated maximum process temperature in the measuring cell is less than the Maximum Media Temperature listed in Part 1.4, the Contractor shall provide a process connection pipe/hose of sufficient length to provide ambient cooling so that the maximum measuring cell temperature is not exceeded.

3.2 FIELD TESTING

The Contractor shall perform the field testing described in Sections 01800 and 11000.

The field test shall insure that the equipment will operate as desired under field conditions. The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

Any defects in the equipment or failure to meet requirements of the Specification shall be promptly corrected by the Contractor.

3.3 MANUFACTURER'S SERVICES

The services of a factory-trained representative of the pressure transmitter manufacturer shall be provided. Services shall include a minimum of 1 day on site. Services shall include inspection and supervision of installation, initial configuration, programming, startup, and adjustments and instruction of the Owner's personnel in operation and maintenance for the pressure transmitters. Instruction and training of the Owner's personnel shall not take place until startup is complete and the pressure transmitters are fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price.

***** END OF SECTION *****

SECTION 13422
FLOAT SWITCHES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing and installing float switches and associated equipment as shown on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning and Training
11000	Equipment General Provisions
Division 16	Electrical

1.3 EQUIPMENT LIST

Equipment numbers are as follows:

<u>Item</u>	<u>Equipment Number</u>
High Level Float Switch	01 LS 01

1.4 DELIVERY, STORAGE AND HANDLING

All equipment shall be completely factory assembled, crated and delivered to protect against damage during shipment.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

1.5 WARRANTY

In addition to the warranty required in the General Conditions, the equipment manufacturer shall provide an extended warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The float switches shall be Flygt Model ENM-10 or approved equivalent equipment manufactured by Warrick Controls, Hydr-O-Matic, or Anchor Scientific.

2.2 FLOAT SWITCHES

Float switches shall be the tilting, non-mercury type. The switch shall be enclosed in a liquid-tight plastic casing with a cable of sufficient length to reach to the terminating device. Float switches shall have either single pole double throw contacts, or single pole single throw contacts. Pole and throw contact number will be determined based on recommendations of the Manufacturer as well as the application for which it will be used.

Mercury switches are not acceptable.

2.3 FACTORY TESTING

The equipment shall be fully tested at the manufacturer's plant before shipment. Tests shall insure that the equipment will operate as desired under anticipated field conditions. Certified copies of test report(s) shall be submitted to the Engineer prior to shipment.

PART 3 EXECUTION

3.1 INSTALLATION

The float switches shall be installed as shown on the Plans and in strict accordance with the manufacturer's recommendations. The float switches shall be mounted and positioned according to the manufacturer's approved method and at heights as directed by the Engineer (where heights are not indicated on the Plans). It shall be suspended at the proper position to hang or float, depending on the liquid level.

The electrical cable, supplied with the float, shall be connected from the float to the terminating device terminal.

3.2 FIELD TESTING

The Contractor shall perform the field testing described in Sections 01800 and 11000.

The field test shall insure that the equipment will operate as desired under field conditions. The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

Any defects in the equipment or failure to meet requirements of the Specification shall be promptly corrected by the Contractor.

3.3 MANUFACTURER'S SERVICES

The services of a factory-trained representative of the float switch Manufacturer shall be provided. Services shall include a minimum of 1 day onsite. Services shall include inspection of the installation, initial configuration, programming, startup, and adjustments and instruction of the Owner's personnel in operation and maintenance. Instruction and training of the Owner's personnel shall not take place until startup is completed and the float switches are fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price.

The representative shall provide for two additional service calls during the initial 2 years of equipment operation.

***** END OF SECTION *****

DIVISION 15
MECHANICAL

SECTION 15050

PIPING SYSTEMS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section describes exposed process and utility piping, fittings, supports, and accessories shown on the Plans, described in these Specifications and as required to completely interconnect all equipment with piping for complete and operable systems inside of buildings and vaults.

The Contractor shall direct the attention of all subcontractors and suppliers of piping systems and related appurtenances for the work to the applicable provisions in the Contract Documents wherever they may occur.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning and Training
02300	Earthwork
02500	Water Distribution
02534	Storm Sewers
09900	Painting
Division 11	Equipment
Division 13	Special Construction
Division 15	Mechanical
Division 16	Electrical

1.3 STANDARDS FOR THE WORK

Pipe, fittings, and supports shall be provided to produce complete, operable systems with all elements properly interconnected as shown in schematic diagrams or to provide specified operations. If a specific dimensioned location is not shown for interconnections or smaller system elements, the Contractor shall select appropriate locations and show them on Shop Drawing submittals for review.

Piping systems and materials shall be new and without imperfections and shall be erected in a neat and workmanlike manner; aligned, leveled, cleaned and adjusted for satisfactory operation; installed in accordance with the best standard practices for this type of work so that connecting and disconnecting of piping and accessories can be readily made and so that all parts are easily accessible for inspection,

operation, maintenance and repair. In order to meet these requirements minor deviation from the Plans may be made as approved by the Engineer.

1.4 PIPE MATERIALS

The materials to be utilized for the various pipe sizes and applications on the project shall be as follows, unless otherwise noted on the Plans or herein:

Potable Water	W	Ductile Iron, MJ
Reservoir Drain	RD	Ductile Iron, MJ
Storm Sewer	SD	DI or PVC (Gravity)

1.5 SUBMITTALS

Submittal data shall be supplied in accordance with Section 01300. Detailed installation drawings of all piping and connected equipment shall be submitted. The drawings shall include all piping, valves, fittings, pipe support locations and types, seismic bracing, and appurtenances.

Submit data to show that the following items conform to the Specification requirements:

- A. Pipe, fittings, and accessories.
- B. Valves.
- C. Couplings and couplers.
- D. Pipe supports and seismic braces as required herein.

Submit certified test reports as required herein and by the referenced standards.

PART 2 PRODUCTS

2.1 GENERAL

Pipe sizes are nominal inside diameter unless otherwise noted.

All materials delivered to the job site shall be new, free from defects, and marked to identify the material, class and other appropriate data such as thickness for piping.

Acceptance of materials shall be subject to strength and quality testing in addition to inspection of the complete product. Acceptance of installed piping systems

shall be based on inspection and leakage tests as specified in Part 3 Execution of this Section.

All water piping shall be certified under NSF 61 and NSF 372 for potable water use.

2.2 DUCTILE IRON PIPE AND FITTINGS

A. GENERAL

Ductile iron pipe shall be centrifugal cast pipe conforming to AWWA C151, Class 52, unless otherwise noted, cement mortar lined in accordance with, AWWA C104. All flanged spools shall be Class 53 as shall all piping where grooved couplings are used. Approved grooved couplings may be used instead of flanged spools and fittings as approved by Engineer.

All above ground piping shall be flanged or grooved piping unless otherwise specified or indicated.

Flanges shall comply with ANSI B16.1, Class 125. Flange gaskets shall be full face. Approved adaptor flanges shall be used instead of flanges where shown on the Plans.

Grooved couplings shall be Victaulic Style 31, or engineer approved equal and shall comply with AWWA C606. Victaulic Style 341 adaptor flanges shall be installed instead of flanges where shown on the Plans.

Fittings shall be ductile iron and shall comply with AWWA C110 or AWWA C153, cement mortar lined, 250-psi minimum pressure. Fittings shall be flanged, or grooved fittings. Fittings with grooved ends shall comply with AWWA C606 and shall be Victaulic or approved equal. Fittings shall not be "Tyton" or other push-on type joint.

The exterior surface of ductile iron pipe and fittings inside of buildings, structures, and vaults shall be painted in accordance with Section 09900 of the Specifications.

2.3 FABRICATED STEEL PIPE AND FITTINGS

Fabricated steel pipe and fittings shall be fabricated from ASTM A570 steel sheet, Grade 36 or stronger, in accordance with AWWA C200.

Minimum wall thickness shall vary in relation to pipe size (outside diameter) as shown in the following table. Where a fitting includes more than one size, then

the minimum wall thickness shall be based on the largest size incorporated in the fitting.

<u>Nominal Pipe Size (inches)</u>	<u>Minimum Wall Thickness (inches)</u>
12" or smaller	0.134

Fittings shall be fabricated with dimensions in accordance with AWWA C208. Flanges shall comply with AWWA C207, Class D for 12 inches and smaller pipe and Class E for pipe large than 12 inches, and be furnished with full face gaskets.

The pipe and fittings shall be cold-tar epoxy lined and tested in accordance with AWWA C210. The nominal thickness of the lining shall be 25 mils.

The exterior of the buried pipe and pipe in contact with concrete shall be coated with a minimum of 80 mils of cold-applied tape coating in accordance with AWWA C214.

2.4 STAINLESS STEEL PIPE AND FITTINGS

Stainless Steel pipe shall be general service made of 316 Stainless Steel. Pipe shall be Schedule 40 with threaded and coupled fittings.

2.5 MISCELLANEOUS FITTINGS

A. FLANGED COUPLING ADAPTERS

Flanged coupling adapters shall be Smith-Blair Type 912 Dresser Style 127, or equal.

B. ADAPTER FLANGES

Adapter flanges for ductile iron pipe shall be manufactured of high strength ductile iron, ASTM A536, Grade 65-45-12. Flange dimensions shall be in accordance with ANSI B16.1, 125-lb. pattern. Gasket shall be Buna-N. Setscrews shall be AISI 4140, high strength, low alloy steel. The adapter flanges shall be Uni-Flange Series 400, or equal.

C. FLEXIBLE CONNECTORS AND EXPANSION JOINTS

Flexible connectors and expansion joints shall be provided where shown on the Plans. The flexible connectors and expansion joints shall be provided with Class 125 ANSI flanges and be single arch-type multiple ply rubber or synthetic elastomers, complete with steel retaining rings, as manufactured by the Red Valve Company, Inc., the Metraflex Company, or equal.

D. DIELECTRIC INSULATED UNIONS

Dielectric insulated unions shall be used to connect dissimilar metals. They shall separate the metals so that the passage of more than one percent of the galvanic current, which would exist with metal to metal contact, is prevented. Unions shall be of the same material as the pipe to which attached, and pressure and temperature ratings shall be no lower than that of the piping system in which it is installed.

E. WALL SLEEVES AND SEALS

Wall and/or floor pipe penetrations shall be made by means of a sleeve capable of being bolted directly to the formwork to prevent misalignment. Seal of the annular space between the carrier pipe and the sleeve shall be by means of a confined rubber gasket and capable of withstanding 350 psi. Sleeve shall be manufactured from Ductile Iron with an integrally cast waterstop of 1/2-inch minimum thickness and 2-1/2-inch minimum height. Wall sleeves shall be omni*sleeve or equal.

Seals for pipe sleeves shall be bolt-up type consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and the sleeve. When bolts are tightened the rubber sealing elements shall expand to result in a watertight seal. Bolts and pressure plate nuts shall be Type 316 stainless steel in below grade or "wet" locations, and of carbon steel at other installations. Rubber links shall be suitable for use in water, moist environments, normal atmospheric conditions, and -40 degrees F to 250 degrees F temperatures for standard service.

PART 3 EXECUTION

3.1 PIPING INSTALLATION

A. GENERAL HANDLING AND PLACING

All piping constructed on this project shall be performed in accordance with the Uniform Plumbing Code. These Plans do not detail all items such as complete venting, etc.; however, it is understood that this work shall be included as a part of this Section and all costs included in the various prices bid.

Pipe and accessories shall be handled in such a manner as to insure delivery on site in sound, undamaged condition. Particular care taken not to injure pipe coating. No other pipe or material of any kind shall be

placed inside of lined pipe or fitting after lining has been applied. All pipe and fittings shall be unloaded, stored, handled in such a manner as to insure against damage. Dropping of pipe or fittings shall be cause for rejection.

The types and sizes of pipes to be used shall be as specified herein and as shown on the Plans. Where sizes of small pipe are omitted from the plans and not mentioned in the Specifications, the sizes to be used shall correspond to plumbing code requirements. In any event, undesignated pipe sizes shall be proper for the function to be performed and as accepted by the Engineer.

All pipe shall be carefully placed and supported at the proper lines and grades and where possible shall be sloped to permit complete drainage. Piping runs shown on the Plans shall be followed as closely as possible, except for minor adjustments to avoid architectural and structural features. If major relocations are required, they shall be approved by the Engineer.

Unions shall be installed in all threaded joint piping to facilitate the removal of sections for maintenance and repair in accordance with the best trade practice. Unions shall be ground joint, malleable iron type. Where unions connect dissimilar materials, the union shall be protected from reaction with dissimilar metals by installation of insulating materials and dielectric unions at contact points.

The interior of all piping shall be cleaned after assembly and before connecting to equipment.

All piping for which no location dimensions are shown shall be installed in a neat and workmanlike manner in accordance with best trade practice. Wherever possible runs and rises shall be grouped and kept parallel. Properly lay out all miscellaneous piping to clear obstructions such as passageways, equipment, larger sized pipes, ventilation ducts, lights, etc.

Whenever pipe requires field cutting to fit in line, work shall be done by a machine in a satisfactory manner so as to leave a smooth end at right angles to axis of pipe.

All pipe shall be installed in strict accordance with manufacturer's recommendations and/or specifications, and best commercial trade practice. Any special tools required for laying, jointing, cutting, etc., shall be supplied and properly used. All pipe shall be kept thoroughly clean until acceptance of completed work, and shall conform accurately to lines and grades given. At all times during pipe laying operations keep trench

free of water either by pumping, bailing, or drainage. Seal end of line with a tight-fitting plug when pipe is not being laid.

Valves shall have interiors cleaned of all foreign matter and inspected, both in open and closed positions prior to installation.

All pipes running through concrete walls below water surface or where subject to groundwater pressure shall be assembled as shown on the plans. Pipes running through concrete not subject to water pressure may be installed through standard steel sleeves, one or two pipe sizes larger than pipe in question. The pipe shall be free of all dirt and grease and thoroughly cleaned to insure a tight bond with the concrete.

All above ground outside pipe carrying liquids shall be insulated.

All buried, submerged, or intermittently submerged piping that is bolted together or uses bolts to hold materials together shall use 316 stainless steel nuts, bolts, and washers. This requirement applies to a distance of 12 inches above the highest water level in any tank, channel, or structure. Otherwise, bolts, nuts, and washers may be hot-dip galvanized steel.

B. GENERAL EXPOSED PIPING INSTALLATION

Unless shown otherwise, piping shall be installed parallel to building lines, plumb, and level.

Piping shall be installed without springing or forcing.

All pipe flanges shall be set level, plumb, and aligned. All flanged fittings shall be true and perpendicular to the axis of the pipe. All bolt holes in flanges shall straddle vertical centerline of pipes.

Flexible couplings shall be provided for all piping connections to motor-driven equipment and where otherwise shown in the Plans. The Contractor may install additional flexible couplings at approved location to facilitate piping installation, provided that he submits complete details describing location, pipe supports, and hydraulic thrust protection.

Unions or flexible couplings shall be installed where shown on the Plans and at all non-motor-driven equipment to facilitate removal of the equipment.

Where equipment drain connections are provided, they shall be valved, with the discharge pipe carried to the nearest floor drain, drain trench, or sump. Where no receptacle for drain exists, drain valves shall be piped to

1 inch above the floor. Drain piping and valve materials shall conform to the requirements of the system served.

All exposed or submerged piping shall be painted and color-coded in accordance with Section 09900, unless otherwise specified.

Flanged joints shall be made in accordance with best trade practice. Screwed flanges for piping shall be run until pipe projects beyond face and no more than one thread is exposed on backside. All flange faces shall then be machined so as to be perfectly parallel. All flanged pipe shall be accurately dimensioned; no “drawing-up” will be allowed. Gaskets shall be full face, rubber.

3.2 GROOVED JOINT PIPING

Grooved joints shall be installed in accordance with the manufacturer’s latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be of an elastomer grade suitable for the intended service, and shall be molded and produced by the coupling manufacturer. The grooved coupling manufacturer’s factory trained representative shall provide on-site training for Contractor’s field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review Contractor is following best recommended practices in grooved product installation. (A distributor’s representative is not considered qualified to conduct the training or jobsite visit(s)).

3.3 PIPE SUPPORTS

Provide all necessary supports, tie rods, bracing, brackets or other types of supports which may be required, as shown on the Plans, or as specified in Section 15066.

3.4 FLEXIBLE COUPLINGS

Flexible couplings shall be installed in accordance with recommendations of manufacturer and used where indicated on the plans. Finished joint shall be airtight or watertight under test pressure of pipeline. Buried flexible couplings shall be coated with asphalt base paint after assembly.

3.5 TESTING

A. GENERAL

All piping shall be tested and inspected in accordance with the provisions of Division 7 WSDOT standard specifications, except as modified herein.

Where new piping systems are being connected to existing piping systems the existing piping systems shall be tested prior to connecting to the new pipe to the existing piping. Once the new piping system has been connected to the existing piping system the entire system shall be tested again.

All piping systems will be tested to demonstrate leak tightness prior to acceptance. The Contractor shall provide all equipment and labor necessary to perform all testing required herein, the costs to be included in the lump sum bid price.

Each particular piping system shall be tested as hereinafter specified. All leaks shall be repaired or defective material replaced and the test repeated as directed by the Engineer. After compliance with test requirements and approval of the Engineer, the field painting, where required, may be started. All pressure testing shall be done prior to any finish painting or pipe insulating.

The Contractor shall be responsible for repair of any damage resulting from or caused by leak testing.

All thrust blocks shall be in place for at least 7 days to allow concrete to cure before testing. Install adequate blocking or other means of resisting test pressure.

B. DISINFECTION

Before being placed into service, all new and modified potable water pipe and appurtenances shall be sterilized and a satisfactory bacteriological report obtained in accordance with Section 7-11.3(12) of the WSDOT Standard Specifications.

As each pipe is laid, sufficient high-test dry calcium Hypochlorite (65 to 70 percent chlorine) shall be placed in the pipe to yield a dosage of not less than 50 mg/l available chlorine, calculated on the volume of water which the pipe and appurtenances will contain. Minimum free chlorine residual after 24 hours shall be 25 mg/l.

During the process of sterilizing, all valves, hydrants, and/or other appurtenances shall be operated to insure complete contact. All closure fittings shall be swabbed with a very strong chlorine solution at least as strong as liquid household bleach (5 to 6 percent chlorine).

Following chlorination, all pipe shall be flushed to remove any solids until a test shows no more than 0.2 parts per million available chlorine. If no

hydrant is installed at the end of the main, then a tap shall be provided large enough to develop a velocity of at least 2.5 FPS in the main.

Before placing the lines into service, a satisfactory report shall be received from the local or state health department on samples collected from representative points in the new pipe after the 24-hour sterilization period has elapsed. Samples for bacteriological tests in the presence of the Owner and transported by the Owner.

Should the initial treatment result in an unsatisfactory bacteriological test or should corrective work be required because of testing, then the chlorination procedure shall be repeated by the Contractor at their own expense until satisfactory results are obtained. These repeat procedures shall follow Section 7-11.3(12) of the WSDOT Standard Specifications, as appropriate and as necessary for the addition of chlorine. The cost of disposal of water used for disinfection shall be borne by the Contractor.

***** END OF SECTION *****

SECTION 15066

PIPE AND CONDUIT SUPPORT SYSTEM

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

The work specified in this Section includes pipe and conduit hangers, brackets, and supports. Pipe and conduit support systems shall be furnished complete with all necessary inserts, bolts, nuts, rods, washers, structural attachments, and other accessories as shown on the Plans and specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
01600	Materials and Equipment
01800	Testing, Commissioning, and Training
09900	Painting
15050	Piping Systems
15400	Plumbing
16050	Basic Electrical Materials and Methods
16130	Raceways and Boxes

1.3 REFERENCES

All pipe and conduit support materials and methods shall conform to the latest, applicable requirements of documents listed hereafter. In case of conflict between this section and the listed documents, the requirements of this Section shall prevail.

ANSI A13.1	Piping and Piping System
ANSI B31.1	Power Piping
ASME	Boiler and Pressure Vessel Code
ANSI/MSS SP-58	Pipe Hangers and Supports C Materials, Design and Manufacture
ANSI/MSS SP-69	Pipe Hangers and Supports C Selection and Application
SMACNA	Seismic Restraint Manual C Guidelines for Mechanical Systems
IPC	International Plumbing Code

1.4 SUBMITTALS

In accordance with the requirements of Section 01300, submit the following project data prepared by a licensed Professional Engineer:

- A. Manufacturer's technical data for all hangers, brackets, supports and documentation of conformance with appropriate standards and these specifications.
- B. Location of pipe and conduit support, including type of structural and pipe attachments, shown on detail drawings and/or specified under paragraph 1.5 of Section 15050.

PART 2 PRODUCTS

2.1 GENERAL

The Contractor shall design, provide, and install pipe and conduit support systems, which include hangers, brackets, supports, anchors, expansion joints, and structural attachments. The support system shall be pipe rack, trapeze pipe hangers or individual pipe clamps, hangers, supports and structural attachments as specified herein. The support system shall be designed in conjunction with the pipe and conduit to be supported. Seismic restraints shall be provided in accordance with SMACNA Manual as referenced in paragraph 1.3.

In certain locations, pipe supports, anchors, and expansion joints have been indicated on the Plans, but no attempt has been made to indicate every pipe support, anchor, and expansion joint. It shall be the Contractor's responsibility to provide a complete system of pipe and conduit supports. Pipe support schedule under paragraph 2.7 of this Section sets forth minimum requirements for pipe supports.

2.2 PIPE RACKS AND TRAPEZE HANGERS

Pipe and conduit racks and trapeze hangers shall be constructed of galvanized steel channels, rods, posts, post base, clamps, brackets, fittings, and accessories for supporting pipes in equipment and pump rooms. All components for pipe and conduit rack and trapeze shall be Unistrut or equal.

2.3 PIPE CLAMPS AND HANGERS

In areas where pipe racks and trapezes are not used, pipe shall be supported with clamp hangers and stanchion saddle support system. The clamps and hangers shall be fastened to threaded rods hanging from structural attachments. Pipe supports shall be selected for the size and type of pipe to which they are applied.

Strap hangers will not be acceptable. Threaded rods shall have sufficient threading to permit the maximum adjustment available in the support item.

All pipe clamps and hangers, including all accessories, shall be galvanized steel for indoor use and Type 316 stainless steel for outdoor use.

Pipe and conduit clamps and hangers shall be as manufactured by Anvil or equal and shall be as follows:

Type	Pipe Size (In.)	Pipe Material	Anvil Figure
Swivel Ring, Split Type	3/4 to 8	All type	104
Split Clamp	1/2 to 3	All type	138R
Adjustable Ring	1/2 to 6	All type	97
Adjustable Ring	1/2 to 4	Copper	CT-269
Adjustable Clevis	3 to 24	All type	590
Pipe Clamp	3 to 42	All type	216
Socket Clamp	4 to 24	Cast Iron	595
Pipe Stanchion	4 to 24	All Type	63
Stanchion Saddle	4 to 36	All type	259
Adjustable Saddle Support	3 to 36	All type	264
Riser Clamp	2 to 24	All type	40
Adjustable Pipe Roll	6 to 12	Stainless Steel	177, 181, or 274

2.4 STRUCTURAL ATTACHMENTS

Structural attachments shall be concrete insert channels or individual inserts for new concrete, surface-mounted channel or individual inserts for existing concrete or where applicable, steel, roof plate supported attachments in the control building, complete with all accessories required. All structural attachments including all accessories shall be galvanized steel for indoor use and stainless steel for outdoor use, and shall be provided by a single manufacturer. Structural attachments shall be as measured by Unistrut Corporation or approved equal.

2.5 PIPE SUPPORT ATTACHMENTS TO CONCRETE

All pipe support attachment to concrete shall be in adhesive anchors unless noted otherwise.

Products which may be incorporated in the work include, but are not limited to, the following:

- A. HIT RE 500 Injection Adhesive Anchor, Hilti, Inc.

- B. HIT HY 150 Injection adhesive Anchor, Hilti, Inc.
- C. Power-Fast, Powers Fasteners, Inc.

2.6 PROTECTION SADDLES

Protection saddles shall be used for protecting pipe insulation against damage at pipe supports or as shown on the Plans. The nominal thickness of covering shall be the same as that of pipe insulation. The protection saddles shall be curved carbon steel plate and shall be Anvil Figure 160 through Figure 166 or approved equal.

2.7 SPACING

Maximum support spacing shall conform to the following table:

Pipe Size Inches	Pipe Material	Maximum Spacing Feet
1" & Smaller	Iron or Steel	6
	Copper	4-1/2
	Plastic	continuous
	Tubing	continuous
1-1/4 to 2"	Iron or Steel	8
	Copper or Plastic	5
2-1/2 to 4"	Iron or Steel	10
	Copper or Plastic	6
6 to 8"	Iron or Steel	12
	Plastic	8

PART 3 EXECUTION

3.1 DESIGN

Pipe and conduit support systems shall be designed in accordance with applicable reference standards specified in paragraph 1.3. Pipe and conduit supports shall be designed and selected to withstand seismic loads for IBC 2015 Seismic Design Category D with $S_s=1.5$ and $S_1=0.599g$ and shall adhere to the following conditions:

- A. Weight balance calculations shall be made to determine the required supporting force at each pipe support location and the pipe weight at each equipment location. Design loads for inserts, clamps, and other support items shall not exceed the manufacturer's recommended loads.
- B. Pipe supports shall be able to support the pipe in all conditions of operation. They shall allow free expansion and contraction of the piping,

and prevent excessive stress resulting from transferred weight being induced into the pipe or connected equipment. Allow clearances for pipe expansion and contraction.

- C. Wherever possible, pipe attachments for horizontal piping shall be pipe clamps, or as shown on the pipe support detail sheet. Horizontal or vertical pipes should be supported preferably at locations of least vertical movement.
- D. All pipe supports shall provide a means of vertical adjustment after erection.
- E. Where practical, riser pipe shall be supported independently of the connected horizontal piping. Pipe support attachments to the riser piping shall be riser clamps.

3.2 INSTALLATION

Pipe support system shall be installed strictly in accordance with standards and codes referenced in paragraph 1.3 of this Section and piping support system manufacturer and piping manufacturer's recommendations.

In addition, all piping shall be rigidly support and anchored so that there is no movement or visible sagging between supports.

Contact between dissimilar metals, including contact between stainless steel and carbon steel, shall be prevented. Supports for brass or copper pipe or tubing shall be copper-plated. Those portions of pipe supports, which contact other dissimilar metals, shall be rubber or vinyl coated.

Anchorage shall be provided to resist thrust due to temperature changes, changes in diameter or direction, or dead-ending. Anchors shall be located as required to force expansion and contract movement to occur at expansion joints, loops, or elbows, and as required to prevent excessive bending stresses and opening of mechanical couplings. Anchorage for temperature changes shall be centered between elbows and mechanical joints used as expansion joints. Anchorage for bellows type expansion joints may be located adjacent to the joint.

Pipe supports and expansion joints are not required in buried piping, but concrete thrust blocking or other approved anchorage shall be provided as indicated on the Plans or specified in other sections.

*****END OF SECTION *****

SECTION 15100

VALVES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section consist of valves and accessories as shown on the Plans, described in these Specifications, and as required inside of buildings and vaults.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning and Training
02500	Water Distribution
Division 11	Equipment
Division 15	Mechanical

1.3 SUBMITTALS

Submit Catalog cuts and shop drawings in accordance with Section 01300 to demonstrate that the valves and appurtenances conform to the Specifications requirements.

The Contractor shall furnish manufacturer's installation and operation manuals, bulletins, and spare parts lists for all valves.

1.4 QUALITY ASSURANCE

All materials and equipment furnished under this Section shall be by the manufacturer specified.

All materials in contact with potable water shall be NSF 61 and NSF 372 certified for potable water use.

See Section 15400 for Plumbing specifications and requirements.

PART 2 PRODUCTS

2.1 GATE VALVES

Gate valves 3 inches and smaller shall be bronze, non-rising stem, wedge disc, 125 pound service, Crane No. 438, Kennedy Figure 427 or equal.

Gate valves larger than 3 inches shall be iron body, bronze mounted, resilient seat, wedge disc, left opening, high-strength bronze stem, O-ring with a 2-inch-square operating nut and complying with AWWA C509 or AWWA C515. Gate valves shall be non-rising stem unless noted otherwise.

Above ground gate valves shall be provided with handwheels.

2.2 BUTTERFLY VALVES

Butterfly valves for air service shall be iron body and disc, Viton resilient seat, stainless steel shaft, bronze bearings, lug body style, suitable for service in air to 350 degrees F. Air service butterfly valves shall be DeZurick, Pratt, or equal.

Butterfly valves for liquid service shall have iron body and disc, Buna N seats attached to the valve body, stainless steel shaft, corrosion resistant bearings, and flanged style body and shall comply with AWWA C504. Extension bonnets shall be sealed from liquid intrusion and shall encase the valve torque tube from the valve trunnion to the top-mounted geared handwheel actuator. The entire assembly shall be factory assembled and tested. Liquid service butterfly valves shall be DeZurik, Pratt 2FII, or equal.

Where butterfly valves are installed adjacent to check valves or other fittings, which interfere with the valve's full range operation, flange fillers, or other spacers, shall be installed between the valve and the obstructing fitting as necessary to insure unrestricted operation of the butterfly valve from full open to closed.

2.3 CHECK VALVES

Check valves for liquid service 3 inches and smaller shall be swing check, bronze body, composition disc, 125 pound service.

Check valves for liquid service larger than 3 inches shall be swing check, outside lever and spring, iron body, stainless steel shaft, bronze mounted with bronze and stainless steel fittings, 125 pound service, Millikin, Mueller A2600 or equal.

Check valves for submerged or intermittently submerged service shall be ball check valves. Manufacturer shall be Flowmatic or equal.

Double Door check valves shall be of the spring-loaded, wafer, double-door type valve. The check valves shall have a cast iron body with stainless steel trim, bronze disc, stainless steel spring and resilient seating suitable for water service. The valves shall have a maximum cold working pressure rating of 160 psig. The disc of the check valves shall be easily removable and replaceable without the need of any special tools. The check valves shall be APCO Series 9000, Duo-Chek, or equal.

Check valves for air service, unless otherwise noted, shall be double door, resilient seating, cast iron body, bronze doors, stainless steel pins and springs, APCO, Dresser or equal.

2.4 COMBINATION AIR AND VACUUM VALVES

The combination air and vacuum release valve shall allow unrestricted venting or re-entry of air, through it, during filling or draining of the pipeline, to prevent water column separation or pipeline collapse during vacuum. The air-vacuum release valve shall incorporate one upper and one lower stainless steel float connected by a common stainless steel float guide, thereby maintaining an air gap between the bottom float and top shut-off float. The internal baffle shall be fitted with a guide bushing and act to protect the shut-off float from direct air flow. The baffle shall retain the 45 Durometer Buna-N seat in place, without distortion, for thigh shut-off. All internals shall be easily removed through the top cover without removing the main valve from the lines. Both floats shall withstand 1,000 psi or more. Valve shall be fitted with blow off valves, quick disconnect couplings and a minimum of 6 feet of hose, to permit back flushing after installation without dismantling the valve. The combination air-vacuum release valves shall be APCO Model Series Series 100 (Water), or equal, with a shut-off and outlet valve, unless otherwise noted on the Plans.

Air release valves on potable and non-potable water pipes shall be APCO Models 50 or 55, or equal. Each air valve shall be provided with an isolation valve for isolation on the inlet side. A vent pipe shall be routed from the valve to within 12 inches of the floor, unless otherwise noted on the Plans. Orifice shall be sized for maximum system pressure. Valve body shall have a minimum pressure rating of 150 psi. Pins, levers, retaining rings, float ball and internal screws shall be stainless steel.

2.5 DUCK BILL CHECK VALVES

Duckbill check valves shall be as manufactured by Tideflex, Red Valve Co., or equal. The materials in contact with domestic water shall be NSF approved.

2.6 VALVE IDENTIFICATION TAGS

Each shut-off or control valve, shall be provided with a 1-1/2-inch minimum diameter heavy brass tag. Tags shall bear the identifying number of the valve and one or more identifying letter symbols of the service line.

Numbers and letters shall be block type with 1/2-inch-high numbers and 1/4-inch-high letters stamped on the tags and filled with black enamel.

Attach tags to the valves by split-key rings soldered so that the ring and tag cannot be removed.

Furnish a drawing and a neatly typed valve directory listing each valve number, type of valve and its location. Submit the directory and drawing to the Owner for approval.

PART 3 EXECUTION

3.1 GENERAL

All valves and accessories shall be installed in a manner and location as shown on the Plans or as required for the application and in accordance with manufacturer's instructions. Valve size is fully equal to line piping in which the valve is installed unless otherwise noted on the Plans. Support all valves where necessary. In case on conflict between these Specifications and a governing code, the more stringent standard shall prevail.

All valves of the same style or type shall be furnished by a single manufacturer.

Provide all accessories necessary for proper valve operation as specified or required for the application. Buried valves shall be installed with square operating nuts and adjustable cast iron valve boxes with covers. Valve boxes shall be set such that the slots in the boxes are in line with the run of pipe the valves are in. Provide two sets of T wrenches for buried valve operation.

Buried valves shall be provided with 1-inch solid steel extension stems with rock guards if the operating nut will be 18 inches or more below the ground surface.

Valves shall be installed with the operator in a position for convenient operation. Particular care shall be taken to insure that space is available for operation of lever or handwheel operated valves without interference to walls, piping or equipment. Any valve which is installed, in the opinion of the Engineer, in a manner that operation is inconvenient shall be modified or removed and reinstalled in a manner suitable to the Engineer at the expense of the Contractor. Operations for manual valves shall be lever or handwheel as is standard with the

manufacturer unless another type of operator is specified or required by the manufacturer.

For submerged valves, provide stem guides as recommended by the valve manufacturer on a spacing of 6'-0". As an alternate, provide valves with extended bonnets where practical. Provide supports for extended bonnets as required. Stem guides and supports shall be 316 stainless steel. All installation fasteners for submerged valves, guides, and supports (nuts, bolts and washers) shall be 316 stainless steel.

***** END OF SECTION *****

SECTION 15700

HEATING, VENTILATION, AND AIR CONDITIONING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section shall consist of the heating, ventilation, and air conditioning equipment and other associated items as shown on the Plans, and as further specified herein.

All permits shall be obtained in accordance with Section 01160.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01160	Regulatory Requirements
01300	Submittals
Division 16	Electrical

1.3 QUALITY ASSURANCE

Submittals shall be in accordance with Section 01300.

All equipment supplied in this Section shall be provided to produce complete, operable systems with all elements properly interconnected as shown in schematic diagrams or to provide specified operations. If a specific dimensioned location is not shown for interconnections or smaller system elements, the Contractor shall select appropriate locations and show them on shop drawing submittal for review.

Equipment and material shall be new and without imperfections and shall be erected in a neat and workmanlike manner; aligned, leveled, cleaned and adjusted for satisfactory operation; installed in accordance with the recommendations of the manufacturers and the best standard practices for this type of work to ensure connecting and disconnecting accessories can be readily made and so that all parts are easily accessible for inspection, operation, maintenance and repair. Oil and lubrication fittings shall be located clear of and away from guards, base, and equipment and within reach from the operating floor whenever possible. In order to meet these requirements with equipment as furnished, minor deviation from the Plans may be made as approved by the Owner.

The manufacturer's recommendations and instructions of products used in the work are hereby made part of these Specifications, except as they may be superseded by other requirements of these Specifications.

1.4 EQUIPMENT LIST

Refer to Heating, Ventilation and Air Conditioning Schedules shown on the Plans.

1.5 SUBMITTALS

Submit manufacturer product data on HVAC equipment, as listed in this Section, under the provisions of Section 01300.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

Equipment manufacturers and model numbers shall be as shown on the Plans except where indicated herein.

2.2 LOUVERS

Louver performance data shall be licensed under the AMCA Certified Ratings Program and shall bear the AMCA Certified Ratings Seal. Certified performance data shall include airflow pressure loss and water penetration.

Louvers shall be stationary type with drainable blades in a 6-inch louver frame. Each stationary blade shall incorporate an integral drain gutter and each jamb shall incorporate an integral downspout so water drains to blade end, then down the downspouts and out at the louver sill. The louver construction shall consist of a frame and blades from aluminum extrusions of minimum 0.081-inch nominal wall thickness. The blades shall be positioned at 37 degree angles. Each louver shall be equipped with a framed, removable, 0.125 x 3/4 flattened aluminum rear-mounted bird screen or 16 x 18 mesh aluminum insect screen. Louvers shall be supplied with a Kynar finish which meets AAMA 2605. Each factory-assembled louver section shall be designed to withstand wind loadings of 25 psf. Drainable blade louvers shall be Greenheck ESD series, or equal.

2.3 GRAVITY BACKDRAFT DAMPERS

Damper air performance data shall be developed in accordance with the latest edition of AMCA Standard 500-D.

Gravity backdraft dampers shall be suitable for pressures up to 1-inch w.g., velocities to 2,500 ft/min and temperatures to 180 degrees F. Gravity-operated back draft dampers shall rotate to the fully open position in the direction of the airflow when subjected to a differential pressure of 0.2 of an inch w.g. or less.

Gravity damper construction shall consist of minimum 18-gauge galvanized steel frame with 2.5-inch to 3.5-inch depth; aluminum blades; 304 stainless steel axles turning in acetal bearings. The damper shall be equipped with extruded vinyl blade seals; and internal aluminum tie bar with spring assist. Finish shall be as shown on equipment schedule. Gravity backdraft dampers shall be Greenheck WD series, or equal.

2.4 ROOF EXHAUST FANS

Fans shall be bear the AMCA Certified Ratings Seal for both sound and air performance and be UL tested and approved.

Roof mounted exhaust fans shall be of down-blast type. The fan, fan housing, and accessories described below shall be one unit supplied by the same manufacturer. Hood construction shall be of heavy extruded aluminum. Fan wheel shall be of backward inclined centrifugal type and be constructed of aluminum. Fan wheel shall be statically and dynamically balanced. Motor shall be a DC electronic commutation type motor specifically designed for fan applications. Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor shall be included. Speed shall be controllable down to 20% of full speed and shall be controlled by either a potentiometer dial mounted on the motor or by a 0-10 VDC signal. Motor shall be permanently lubricated, heavy duty ball bearing type. The fan shall be complete with bird screen, vibration isolators, and gravity back-draft damper designed with edge seals. Roof exhaust fans shall be Greenheck G series, or equal.

2.5 ELECTRIC UNIT HEATERS

Heaters shall be UL Listed, CSA Certified and meet requirements of the National Electrical Code.

Heaters shall be horizontal or vertical mount type. Heater housing shall be constructed of heavy gauge steel. Heaters shall be fan-forced air unit with aluminum finned, copper clad heating elements. The fan shall be completely enclosed and dynamically balanced. The unit shall be complete with pivotal wall or ceiling mounting kit as specified on Plans, control transformer, automatic reset thermal overheat protector, adjustable louvered outlet grille and enamel finished steel housing; all shall be one unit supplied by the same manufacturer. Unit heaters shall be Qmark MUH series, or equal.

2.6 THERMOSTATS

Provide thermostats, as required to control heating and ventilating equipment. Thermostats shall be located on an interior wall that does not receive direct solar exposure unless otherwise indicated.

Modulating thermostats shall regulate fan speed based on level of temperature space. Control shall include a Proportional Integral Derivative (PID) feedback loop and shall have labeled terminal strips. Control shall output a 0-10 VDC signal to operate an electronic commutation (EC) motor. Temperature setpoint range shall be 50-90 °F. Modulating thermostats shall be Greenheck Temperature/Humidity Control, or equal. Contractor shall provide power wire and appropriate conduit installation for all powered thermostats.

2.7 TAPE

Non-combustible, three inches in size, foil backing, pressure-sensitive lap of facing material. NASHUA 322, NASHUA FSK (High Pressure) or equal.

2.8 METAL DUCTWORK

Metal ductwork for air supply and return air shall be fabricated in accordance with ASTM A527 (galvanized sheet metal) or ASTM A167, ANSI Type 302/304 (stainless steel sheets) if S.S. ductwork is shown on the Plans. Metal ductwork shall be rigidly constructed and installed. Slip joints shall be in the direction of air flow. All joints shall be sealed tight. Bonding materials for sealing duct system and attaching insulation shall be supplied by manufacture. Ducting shall be United McGill, SMACNA or equal.

Hangers shall be secured to the ceiling or walls and shall be adequate to support ductwork. Where ducts go through walls, there shall be 1/4-inch clearance left and this area shall be sealed tight with compatible mastic and foam rubber and the penetration area covered over with flanges that are secured to the ductwork only. Volume dampers shall be located as shown on the Plans, and at a minimum of one damper for each branch duct installed. Dampers are to be of the same material as the ducts they are installed in. Fire dampers shall be installed in ductwork as directed by the Building Permit or required by the Owner.

Ductwork shall be installed and supported to comply with the requirements and recommendations of Sheet Metal and Air Conditioning Contractors National Association (SMACNA) HVAC Duct Construction Standards. Sheet metal plenum shall be constructed of not lighter than 18-gauge galvanized steel and reinforced with 1-1/2-inch by 1-1/2-inch by 1/8-inch angles as required to prevent drumming or breathing. Access openings and covers shall be provided for cleaning, wiring and servicing motors, filters, fans and dampers located within or blocked by sheet metal work.

2.9 DUCT HANGERS AND SUPPORTS

Comply with requirements and recommendations of Sheetmetal and Air Conditioning Contractors National Association (SMACNA) HVAC Duct Construction Standards.

Conform to requirements of SMACNA "Seismic Restraint Manual Guidelines for Mechanical Systems."

Furnish standard and fabricated hangers and supports complete with necessary inserts, bolts, nuts, rods, washers and other accessories.

Hanger straps and rods shall be in accord with SMACNA Duct Construction Standards.

Fasten bracing to ductwork, including riveting, bolting, and tack welding per SMACNA.

Provide galvanized steel band or fabricated angle iron brackets for wall supports, except in wet well area where stainless steel components are required.

A. HANGER RODS

Carbon Steel, with hex nuts and flat washers.

B. CONCRETE INSERTS

1. Continuous channel - Unistrut.
2. Universal, malleable iron - Type 18, FS WW-H-171.

Beam Clamps and Attachments as required.

2.10 SEISMIC SUPPORTS

All HVAC supports, tie rods, bracing, brackets or other types of supports shall be designed in accordance with the current edition of the International Building Code (IBC) and ASCE 7-10. Evaluate the seismic loads in accordance with IBC and Chapter 13 of ASCE 7-10 for the seismic design parameters shown on the Plans.

PART 3 EXECUTION

3.1 INSTALLATION

All materials shall be installed as shown on the Plans and according to manufacturer's recommendations. Adjust all dampers and louvers to provide tight seal when closed and unobstructed flow when open. Provide all necessary controls, and coordinate all control wiring with Division 16. All installed equipment shall function in manner intended.

The heating/cooling system shall be installed as shown on the Plans and shall be connected to any ductwork with flexible connections. The Contractor shall be responsible for the installation of any condensate drain piping and conduit/wire runs for controllers/thermostats.

3.2 TESTING, ADJUSTING AND BALANCING

A. QUALIFICATIONS

All work shall be performed under the direct supervision of an AABC Certified Test and Balance Engineer. Resumes including education, experience, and certification of each person on the project shall be submitted for review and approval by the Owner. Notify the Owner 10 days prior to testing. The Owner shall witness the testing and balancing.

B. INSTRUMENTATION

All instruments used will be currently calibrated and listed in the TAB report showing instrument description, serial number, and date of calibration.

C. AIR BALANCE

When systems are complete and ready for operation, the TAB Agency will perform a final air balance for all air systems and record the results. The volume of air for the supply, return, exhaust, and outside air equipment and terminals will be tested and balanced within the tolerances of the AABC Standard. The general scope of balancing by the TAB Agency will include, but is not limited to, the following:

1. Fan Speed

Measure and record RPM at each fan speed.

2. Voltage and Amperage Readings

Measure and record the final operating amperages and voltage for each motor.

3. Static Pressure Profile

Static pressure profiles shall be measured and recorded across each supply fan, cooling coil, heating coil, return air fan, air handling unit filter, and exhaust fan, and at the furthest air device or terminal unit from the air handler supplying that device. Static pressure profiles shall also be provided for systems, which do not perform as designed.

4. Equipment Air Flow

Adjust and record exhaust, return, outside, and supply air CFM and temperatures, as applicable, at each fan.

D. REPORTS

The report will contain all required information as described within this specification, including the information formatted and shown in the AABC Standard. Include with the data the date tested, personnel present, records of test instruments used, and a list of all measurements taken. All measurements and recorded readings (of air, water, electricity, etc.) that appear in the reports shall be certified by the Agency's Test and Balance Engineer. Six copies of the final report shall be submitted to the Owner indicating a summary of actual operating data and any abnormal operating conditions.

E. EXECUTION

1. Provide additional dampers, and clean filters as specified herein and shown on the Plans.
2. Put all system and equipment into operation and continue operation until all adjusting, balancing, testing, demonstrations, instructions, and cleaning of systems have been completed.
3. Do not begin testing and balancing until systems are completed and in good working order.
4. Check motors for proper rotation, coupling and drive alignment, belt tension, and freedom from vibration, etc.

5. Make all changes to drives and dampers as necessary to accomplish specified airflows.

*****END OF SECTION*****

DIVISION 16
ELECTRICAL

SECTION 16050

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the requirements and methods for furnishing and installing the basic electrical materials, and other associated items as shown on the Plans, and as further specified herein.

1.2 RELATED WORKS SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
01800	Testing, Commissioning, and Training
02300	Site Earthwork
Division 3	Concrete
09900	Painting
11000	Equipment General Provisions
Division 15	Mechanical
Division 16	Electrical

1.3 DEFINITIONS

A. ADJUSTABLE SPEED DRIVE CONTROLLERS

Adjustable speed drives are variable frequency AC drives used to power AC squirrel-cage induction motors at variable frequencies, which relate directly to variable speed. These drives are also commonly known as Variable Frequency Drives (VFDs).

Basic design typically consists of AC to DC conversion followed by AC output wave simulation using pulse-width modulation (PWM). This simulated output power signal will appear to the motor as a representation of an adjustable frequency sine wave. This output may be electrically noisy.

B. ANALOG I/O

Analog I/O are PLC input/output electronic signals that are contiguous over time. Analog signals represent a large number of values within a specific range.

C. ATTICS

Attics shall be considered those closed environments between ceilings and roofing that allow full entry of personnel by use of ladders, pull-down stairs, or other special means.

ATTICS are considered dry crawl spaces (see CRAWL SPACES).

Tight spaces between ceilings and roofs that do not allow full entry of personnel are considered concealed areas (see CONCEALED AREAS).

D. CONCEALED AREAS

Locations that are underground, within walls, or within other areas that do not allow full entry of personnel are considered concealed. Concealed areas are not exposed (see EXPOSED AREAS) or accessible (see ATTICS and CRAWL SPACES).

E. CONTROL PANELS

Control Panels shall be defined as enclosures that contain electrical devices capable of controlling, altering, indicating or displaying the function or conditions of electrical circuits. Unlike junction boxes, Control Panels are not just used for the redirection or reconnection of electrical circuits.

F. CONVENIENCE RECEPTACLES

120 Vac general-purpose receptacles that are not dedicated to a specific function or piece of equipment. Receptacles dedicated to computers, heat tracing, fans, louvers, and etc., are not considered convenience receptacles.

G. CRAWL SPACES

Crawl spaces shall be considered those closed environments that are not normally accessible to personnel, but that allow full entry of personnel by special means.

Crawl spaces are considered exposed areas and may be dry or wet (see ATTICS).

H. DAMP AREAS

Damp areas are considered wet (see WET AREAS).

I. DEDICATED RECEPTACLES

Dedicated receptacles are provided for a specific receptacle load such as computers, heat tracing, fans, louvers, metering pumps, sump pumps, and etc. Dedicated receptacles are not intended for general use.

J. DIGITAL I/O

A digital I/O point consists of a single input or output binary bit at one of two possible states, which may be represented as 1's or 0's, ON or OFF, YES or NO, TRUE or FALSE, etc. Digital I/O may also be called "discrete" I/O. Within these specifications, both terms are synonymous.

K. DRY AREAS

Locations not normally subject to dampness or wetness. A location classified as dry may be temporarily subjected to dampness or wetness, as in the case of a building under construction (see FINISHED AREAS).

Rooms containing process water, chemical piping, or related equipment are not considered DRY. Areas that are not considered DRY are considered WET.

L. EXPOSED AREAS

Locations that are visible, outdoors, or exposed to a process or room environment. Exposed areas are not concealed (see CONCEALED AREAS).

M. FINISHED AREAS

Indoor confined areas that are not directly exposed to a process or process chemicals. They typically include closed offices, bathrooms, laboratories, lunch/break rooms, etc. Finished areas are considered DRY.

N. HOT SPARE

A "Hot Spare" is a PLC analog or digital channel in a PLC card that is powered but the channel is unassigned. Hot spares are connected to fused field I/O terminal block groups per Specification 16940.

O. INDOOR AREAS

Confined locations where the equipment is normally protected from wind, dust, rain, snow, and other natural elements. INDOOR areas are not the same as DRY areas.

P. I/O

Inputs/Outputs – Input and output signals into and out of a PLC or RTU.

Q. OIU

Operator Interface Unit – A graphical display of industrial plant system variables and status. It may also allow for process control adjustments. Navigation of its programming may be via keypad, touch screen, or a combination of both. An OIU is typically located on a field control panel or control panel in an electrical equipment room.

An Operator Interface Unit is considered a possible extension of a PLC, like an I/O or network card. PLC installations may or may not include an OIU.

R. OUTDOOR AREAS

Locations where the equipment is normally exposed, or partially exposed, to weather in the form of wind, dust, rain, snow, and other natural elements.

S. PROCESS AREAS

Process areas are those areas that are directly exposed to process moisture, or that may be subjected to moisture in the event of a process leak or failure. They typically include pump rooms, chemical rooms, and direct process-exposure areas such as clearwells, open filters, and reservoirs. Process areas are considered WET.

T. PLC

Programmable Logic Controller – A device used to monitor and control system process. It can be used stand-alone or in conjunction with other systems such as SCADA. It may provide telemetric functions or interface with telemetric equipment.

U. SHOP FABRICATED

Manufactured or assembled equipment for which a UL test procedure has not been established.

V. VARIABLE FREQUENCY DRIVES (VFDs)

See ADJUSTABLE SPEED CONTROLLERS in this Section.

W. VIBRATING EQUIPMENT

Equipment that is subject to vibration under normal operating conditions, such as motors, transformers, electrically operated valves, etc.

X. WET AREAS

Locations outdoors, underground, directly or indirectly exposed to the process, in concrete slabs or masonry in direct contact with the earth, or in any other way subject to saturation with water or other liquids.

1.4 REFERENCES

Unless otherwise noted, the requirements of the following code-making authorities and standard organizations apply:

<u>References</u>	<u>Title</u>
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society of North America
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NRTL	National Recognized Testing Laboratory
OSHA	Occupational, Health, and Safety Administration
UL	Underwriters Laboratories, Inc.
UL 508	Safety Industrial Control Equipment
WAC 296-46B	Washington Administrative Code, Electrical Safety Standards, Administration, and Installation

In case of conflict or disagreement between codes, standards, laws, ordinances, rules, regulations, plans, and specifications, the more stringent condition shall govern.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Prior to submittal of shop plans, coordinate all electrical equipment, particularly motor control equipment, process and control panels, and instrumentation, with related manufacturers and with other applicable equipment and systems specified in other divisions of the Specifications.
- C. Provide submittals in the following manner:
 - 1. Organize the submittals by CSI code type.
 - 2. Clearly show the Tag Number associated with each submittal within each CSI grouping.
 - 3. Include non-tagged devices such as grounding systems, conduits, wireway, ductbank details, wire, cable, boxes, fittings, switches and receptacles.
 - 4. Clearly show the specific part, part number, order code, etc. associated with the device. Use pointers, highlights, circles, etc. to clearly identify the specific part.
 - 5. Submit on distribution equipment, including but not limited to: Unit substations, Medium voltage switching equipment, motor control centers and control equipment, low voltage switchboards, safety switches, dry-type (specialty) transformers, panelboards, and grounding.
 - 6. Submit on generators and automatic transfer switches.
 - 7. Submit on lamps, lighting, site lighting, and wiring devices.
- D. Provide manufacturer's product technical data including, but not limited to:
 - 1. Manufacturer's name, address, and contact number.
 - 2. Manufacturer's product descriptive bulletin.
 - 3. Nameplate data, current, voltage, load, impedance, and other electrical data pertinent to the Project and necessary to assure compliance with the Specifications and Plans.

- E. Clearly, indicate on submittals that the equipment or material is NRTL listed or is constructed of listed or recognized components. Where a NRTL standard has not been established, clearly identify that no NRTL standard exists for that equipment.

- F. OPERATION AND MAINTENANCE MANUALS

Reference base requirements in specification 01300.

Manuals for the electrical system shall also include:

1. Manuals for fabricated control panels. Wiring diagrams shall include updated title block showing the date redline field changes were incorporated into the documentation.
2. In each section, compile a spare parts list and supplier index.
3. Assemble records of all tests, measurements, and calibration settings made for each device.
4. The Contractor shall supply three CD-Rom or USB copies of the final equipment manuals in a tabbed, searchable, .pdf format, with a table of contents bookmarked to provide a navigation link to each section of the manual(s).

1.6 SYSTEM DESCRIPTION

- A. Provide the labor, materials, and equipment necessary to furnish, install, and place into operation complete power, lighting, control, alarm, communications, and instrumentation electrical system of this Contract as shown on the Plans or Specifications herein.
- B. Provide a functioning system(s) in compliance with manufacturer's instructions, performance requirements as specified or indicated, and modifications resulting from reviewed shop plans and field coordinated plans.
- C. Provide complete wiring and controls for all equipment specified under other divisions and that comply with Division 16.
 1. Connect motors, controls, meters, and any other electrical device installed or provided as part of the project.
- D. Pay and make arrangements for necessary permits, licenses, and inspections.

1.7 QUALITY ASSURANCE

A. TESTING AGENCY QUALIFICATIONS

A “Nationally Recognized Testing Laboratory” (NRTL) recognized and approved by the State of Washington.

1. Testing Agency Field Supervision: Use persons currently certified by NETA or the National Institute for Certification in Engineering Technologies, or equal, to supervise onsite testing specified in Part 3.

B. Comply with NFPA 70 (NEC) for components and installation.

C. LISTING AND LABELING

Provide products specified in this Section that are listed and labeled.

1. The Terms “Listed and Labeled:” As defined in the National Electrical Code, Article 100.
2. Listing and Labeling Agency Qualifications
 - a. A NRTL recognized and approved by the State of Washington.

1.8 DELIVERY, STORAGE AND HANDLING

Ensure that equipment is not used as steps, ladders, scaffolds, platforms, or for storage – either inside or on top of enclosures. Protect nameplates on electrical equipment from being defaced. Repair or replace damaged, corroded, and rejected items at no additional cost to the Owner.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Refer to individual Division 16 sections.

1. Similar equipment shall be provided by only one manufacturer throughout the project unless otherwise noted in the Specifications.

B. Submit requests for substitution in accordance with Section 01300.

- C. Trade names and catalog numbers may be used in the Plans or Specifications to establish quality standards and basis of design:
 - 1. Other listed manufacturers in the applicable specification sections with equal equipment may be acceptable.

2.2 GENERAL PRODUCT REQUIREMENTS

- A. Except as otherwise indicated, provide new materials and equipment, which are standard products of manufacturers, regularly engaged in production of such equipment. Provide material or equipment approved and labeled for the purpose for which it is to be used by NRTL or other organizations acceptable to the State of Washington Department of Labor and Industries.
- B. Where voltage, current, power, temperature or other ratings are specified that do not correspond to standard ratings of the manufacturer selected by the Contractor, furnish the next rating level which is more conservative or increases the capacity of the device or material in question.
- C. Furnish materials, devices, and equipment that are non-corrosive or coat them in a manner that renders them non-corrosive and acceptable to the Engineer. Do not provide materials, which contain polychlorinated biphenyls, asbestos, or other hazardous or detrimental materials. Do not install materials in a location or construction manner that produces galvanic action or do not install material combinations with corroding or eroding action.
- D. Where changes in the work, or substitutions in material are proposed, ensure that sizes, weights, openings, etc., are provided that do not require changes in the work outside this Division.
- E. All terminals shall be suitable for 75 degrees C rated copper conductors.

2.3 FABRICATION

- A. When equipment is shop fabricated specifically for this Project, use electrical devices and enclosures, which are NRTL, listed and labeled or recognized.
- B. SHOP OR FACTORY FINISHES
 - 1. See Division 11 and Section 09900.

2. Interiors of other painted electrical equipment shall be either white or light gray.
- C. Fabricate equipment or devices in the field equivalent in every respect to manufactured items used for the same purpose. Where cutting, drilling, grinding, etc., is done to galvanize or painted metal, regalvanize, or paint to match original finish.

2.4 SUPPORTING DEVICES

- A. Channel and angle support systems, hangers, anchors, sleeves, brackets, fabricated items, and fasteners are designed to provide secure support from the building structure for electrical components.
 1. Material

Steel, except as otherwise indicated, protected from corrosion with zinc coating, or with treatment of equivalent corrosion resistance using approved alternative finish or inherent material characteristics.
 2. Metal Items for Use Outdoors or in Damp Locations

Hot-dip galvanized steel, or stainless steel, except as otherwise indicated.
- B. ANCHORS

Galvanized steel in dry areas; stainless steel or hot dipped galvanized steel in wet areas.

 1. Lag screws or Type A tapping screws for wood.
 2. Rockwell “well-nut” for light loads in masonry.
 3. Thru-bolt with fender washers for heavy loads in masonry.
 4. Toggle bolts with springhead for hollow partitions.
 5. Self-drilling anchors with threaded studs for concrete.
 6. Clamps or U-bolts for structural steel.
 7. Self-drilling anchors with extension rods for hollow tile over concrete.

C. SHEET-METAL SLEEVES

0.0276 of an inch or heavier galvanized sheet steel, round tube, closed with welded longitudinal joint.

D. PIPE SLEEVES

ASTM A53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.

2.5 ELECTRICAL IDENTIFICATION

A. MANUFACTURER'S STANDARD PRODUCTS

Where more than one type is listed for a specified application, selection is Installer's option but provide single type for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and Specifications.

B. COLORED ADHESIVE MARKING TAPE FOR RACEWAYS, WIRES, AND CABLES

Self-adhesive vinyl tape, not less than 3 mils thick by 1 inch wide.

C. UNDERGROUND LINE WARNING TAPE

Provide bright-colored, vinyl tape not less than 3-mils thick by 6-inches wide compounded for direct-burial service with permanent and continuous print.

D. TAPE MARKERS

Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

E. COLOR-CODING CABLE TIES

Type 6/6 nylon, self-locking type. Colors to suit coding scheme.

F. FASTENERS FOR PLASTIC-LAMINATED AND METAL SIGNS

Self-tapping stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

G. FLASH PROTECTION WARNING

Provide Arc Flash Warning Label on all equipment as required by 110.16 NEC (2020). The label is to contain the following text:

WARNING or DANGER
Arc Flash Hazard!
Follow requirements in NFPA 70E
for safe work practices and
appropriate PPE. Failure to comply
can result in death or injury.

2.6 TOUCHUP PAINT

Use touchup paint on equipment provided by equipment manufacturer and select color to match existing equipment finish.

A. FOR NON-EQUIPMENT SURFACES

Matching type and color of undamaged, existing adjacent finish.

B. FOR GALVANIZED SURFACES

Zinc-rich paint recommended by equipment manufacturer.

PART 3 EXECUTION

3.1 ELECTRICAL SUPPORTING METHODS

A. WET AREAS

1. For pullboxes and equipment vaults, reference Specification Section 16130.
2. For wet areas which are not pullboxes or equipment vaults, hot-dip galvanized materials, stainless steel materials, or nonmetallic, U-channel system components unless otherwise noted on the Plans.

B. DRY AREAS

Hot-dip galvanized materials unless otherwise noted on the Plans.

C. **METHODS**

Support raceway, equipment, and devices from framing members or building structure with sufficient clearance for maintaining and servicing. Provide backing plates, and/or framing material to support equipment, devices, and materials, which are located between the building or facility structure-framing members.

3.2 RECORDS

- A. Maintain and annotate on the job at all times a separate set of Record Drawings in accordance with the General Conditions. Show changes from the Contract Documents, routing of hidden raceways, actual fixture and equipment locations, equipment sizes and dimensions and building outline changes. At the end of the Project, provide the Engineer a complete set of Plans marked in red pencil in a manner consistent with the Contract Plans, indicating the changes made on the job.
- B. Record voltage, current, and megohmmeter and ground ohmic resistance test measurements made on the electrical work, the trip units, fuses, and overload relay elements installed in the equipment and the setting of all pressure, flow, level, etc., control devices. When the Project is completed and operating, turn over these records to the Owner.
- C. Equipment and raceways installed under this contract for future work shall be dimensioned on the Record Drawings.

3.3 COORDINATION

- A. Arrange for chases, slots, and openings in building structure during progress of construction to allow for electrical installations. Obtain approval from structural Engineer for penetration of structural components prior to penetrating the component.
- B. Coordinate installation of supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the work. Coordinate installation of large equipment requiring positioning prior to closing in the building.
- D. Coordinate the location of motors, switches, panel connections, and other points of connection with the equipment manufacturers or vendors prior to conduit installation. Route circuits to the actual connection point. Even if

removal and reinstallation of building materials is necessary, remove and reinstall conduit, outlet boxes, and other electrical connections, if initial electrical connections are not made to the appropriate equipment location.

- E. Coordinate and schedule connecting electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
- F. Coordinate and verify work under Division 16 with work under other Divisions, cooperate in locating equipment to avoid interference with work of others, and plan work to harmonize with the work of other trades so that all work may proceed as expeditiously as possible. Coordinate the installing of built-in work, attaching items to buildings, and cutting and patching. Coordinate connecting electrical circuits to components furnished under other Divisions. (Portions of the electrical design are based upon the equipment specified in other Divisions.) No extras are allowed because of moving work required to avoid interference with work of other Contractors.
- G. Coordinate installing electrical identification after completion of finishing work where identification is applied to field-finished surfaces.
- H. Where changes in the work, or substitutions in material are proposed, ensure that sizes, weights, openings, etc., are provided that do not require changes in the work outside this Division.

3.4 INSTALLATION

A. ENCLOSURES FOR USE WITH ELECTRICAL EQUIPMENT

Unless specifically called out otherwise on the Plans, electrical enclosures shall meet the following specification:

1. Dry Areas

NEMA 1.

2. Wet Areas

a. Indoors

NEMA 12 where the enclosure will not be subjected to splashing water or hose-directed water.

b. Outdoors

NEMA 3R where the enclosure will not be subjected to splashing water, hose-directed water, or windblown dust.

3. Exceptions to 1-2

a. As otherwise indicated on the Plans.

b. As modified in other Division 16 sections.

4. Standards

a. NEMA ICS-6, Enclosures for Industrial Controls and Systems.

b. UL 508A, Standard for Industrial Control Panels.

B. WORKMANSHIP

Install the equipment and materials in a neat and workmanlike manner employing workers skilled in the particular trade and in accordance with the manufacturer's instructions, the National Electric Code, National Electric Safety Code, applicable local regulations, ordinances, and industry standards. A person in charge at the site shall maintain adequate supervision of the work under this division when necessary for coordination with other work.

C. SELF-SUPPORTED EQUIPMENT

Install self-supporting equipment in a level and plumb manner, shimming with full width stainless steel shims, as necessary. Bolt units to the floor with stainless steel expansion anchors and bolts, or weld units to embedded steel channels. Floor or pad shall be level within plus or minus 1/8 of an inch in a square yard before installing equipment. Grout or caulk enclosure to floor or pad. Provide bushings on conduits entering from above or at the side. For conduits entering from below, install grounded insulating bushings bonded to the ground bus or pad.

D. MOUNTING HEIGHT

Install components and equipment to provide the maximum possible headroom where mounting heights or other location criteria are not indicated. Mount enclosures for individual units at 54 inches above floors to centerline of controls unless otherwise indicated in the Plans.

E. ACCESSIBILITY

Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, while minimizing interference with other installations.

F. EQUIPMENT ORIENTATION

Install items parallel and/or perpendicular to other building systems and components, except where otherwise indicated.

G. EQUIPMENT MOUNTED ENCLOSURES

Attach enclosures mounted on equipment with machine screws or clamps as required. Do not drill equipment frames or sheets without permission of supplier/manufacturer or the Engineer.

Do not mount safety switches and external equipment to other equipment enclosures, unless enclosure mounting surface is properly braced to accept mounting of external equipment.

H. COORDINATION

Give right of way to raceways and piping systems installed at a required slope.

I. WALL MOUNTED ENCLOSURES

Stand equipment off wall surfaces a minimum of 1/4 of an inch where enclosures are mounted on walls in WET AREAS with neoprene or plastic shim washers.

J. MISCELLANEOUS SUPPORTS

Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices, except where components are mounted directly to a structural member of adequate strength.

K. SLEEVES

Install for cable and raceway penetrations of concrete slabs and walls, except where core-drilled holes are used. Install for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other

fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

L. FASTENING

Unless otherwise indicated, securely fasten electrical items and their supporting hardware to the building structure.

1. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or any other items.
2. Select fasteners so the load applied to any fastener does not exceed 25 percent of the proof-test load.

M. FIREPROOFING

1. Do not remove or damage fireproofing materials.
2. Install hangers, inserts, supports, and anchors prior to installation of fireproofing.
3. Repair or replace fireproofing removed or damaged.

N. PENETRATIONS

Make all penetrations of electrical work through walls and roofs water and weather-tight.

O. MISCELLANEOUS REQUIREMENTS

1. Screen or seal all openings into outdoor equipment to prevent the entrance of rodents and insects.
2. Equipment fabricated from aluminum shall not be placed in direct contact with earth or concrete.
3. Do not exceed the dimensions indicated for equipment except as approved in writing by the Engineer.
4. Do not use equipment or arrangements for equipment that reduce the required clearance or exceed the space allocations.

P. DIMENSIONS

Dimensions indicated for electrical equipment and dimensions indicated for the installation of electrical equipment are restrictive dimensions.

1. Field measurements take precedence over dimensioned plans.

3.5 IDENTIFICATION

A. LABELS

Install labels where indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment. Conduit labeling is further described in section 16130. The labeling of conductors is further described in section 16120.

B. NOMENCLATURE

Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated on the Contract Documents or required by codes and standards. Use consistent designations throughout the Project.

C. SELF-ADHESIVE IDENTIFICATION PRODUCTS

Clean surfaces of dust, loose material, and oily films before applying.

D. IDENTIFY PATHS OF UNDERGROUND ELECTRICAL LINES

During trench backfilling, for exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above power and communication lines. Where multiple lines installed in a common trench or concrete envelope, do not exceed an overall width of 16 inches, use a single line marker.

E. ENGRAVED, PLASTIC-LAMINATED LABELS, SIGNS, AND INSTRUCTION PLATES

Engraving stock shall be melamine plastic laminate punched for mechanical fasteners with a minimum thickness of 1/16 of an inch for signs up to 20 square inches, and 1/8 of an inch thick for larger sizes. Engraved legend in white letters on black face. Provide nameplates on equipment enclosures giving the name and circuit identification of the enclosed device/equipment in 1/4 of an inch lettering.

F. PANELBOARD SCHEDULES

For panelboards, provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker.

G. ARC FLASH HAZARD

Provide and install warning labels for arc flash hazard on all switchboards, panelboards, control panels, motor control centers, and other equipment per the requirements of the NEC and Washington State Administrative Code (WAC).

3.6 CUTTING AND PATCHING

Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for electrical installations. Perform cutting by skilled mechanics of the trades involved.

Repair disturbed surfaces to match adjacent undisturbed surfaces.

3.7 TOUCHUP PAINTING

Thoroughly clean damaged areas and provide primer, intermediate, and finish coats to suit the degree of damage at each location.

Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.

3.8 EXTRA MATERIALS

Extra materials in this Section cover all spare parts for electrical devices under this contract and are centrally listed here for clarification and completeness. Spares shall match products installed, and shall be packaged with protective covering for storage and identified with labels describing the contents within.

A. GENERATOR ASSEMBLIES (ASSOCIATED CSI SECTION – 16230)

1. Power Fuses (line power)

Provide 3 spare power fuses of each type and rating.

2. Control Fuses

Provide 10 percent (minimum of two) spare control fuses of each type and rating to cover all motor starters (not per starter).

Provide 1 control fuse puller.

3. Filters

Provide two sets each of lubricating oil, fuel, and combustion air filters.

4. V-Belts

Provide one complete replacement set of all V-belts.

5. Touchup Paint

Provide 1 quart (minimum) of touchup paint matching each color utilized on generator set.

6. Provide spare parts in suitable boxed watertight container marked "GENERATOR SPARE PARTS" and deliver to the Owner. Label with supplier's/manufacturer's name, the model number of the generator set, and the 24-hour service telephone number.

B. PANELBOARDS (ASSOCIATED CSI SECTION – 16440)

1. Cabinet Keys

Provide three spares of each type of key for panelboard cabinet locks.

2. Provide a latching plastic container with a printed label adhered to the lid stating "PANELBOARD SPARE KEYS."

3.9 TESTING NOT REQUIRING THIRD PARTY

Test electrical equipment before energization and placing into service. Report all test results in writing. Where tests disclose a defect in the work, rework, or repair the work at no additional expense to the Owner and retest to confirm the rework or repair until testing confirms that the defect has been corrected. Test in accordance with the manufacturer's installation and testing instructions and the applicable electrical standards (i.e., NEMA, NFPA, IEEE, ISA, ANSI) for the class of equipment

A. CONDUCTOR MEGGER TEST

1. Power Conductor Testing

After pulling and prior to connection perform a Megger test between all power conductors (including the equipment ground) and between each power conductor and earth ground in the following manner:

- a. Perform megger tests at 600 V.
- b. Record ambient temperature and humidity during testing.
- c. Cables or conductors with a steady-state value less than 100 megohms shall be considered “failed”.
- d. Failed cables and conductors shall be removed and replaced with new and retested per these specifications.
- e. Provide a Power Conductor Megger Testing Report. A blank copy of this report, specifically associated with this contract, is available from Engineering on request. A copy of these signed test results shall be submitted to the Engineer for approval prior to startup and shall be included in the O&M Manual.

2. Control Conductor Testing

- a. Control conductor insulation testing is not required.

3. Instrumentation Conductor Testing

- b. Instrumentation conductor insulation testing is not required.

B. CONDUCTOR INSPECTION

On installation of wires and cables and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures

- a. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.3.2. Certify compliance with test parameters.
- b. Remove and replace conductors with visible insulation damage on conductor ends due to installation in an incomplete or damaged conduit system such as, but not limited to, missing bushings or burrs on conduit ends.

C. MOTOR COMMISSIONING TEST

1. Provide a Motor Commissioning Test Report for each new or refurbished motor. A blank copy of this report, specifically associated with this contract, is available from Engineering on request. Motor Commissioning Test Reports shall be signed by the Contractor and approved by the Engineer prior to energizing the motors. A copy of these signed test results shall be included in the O&M Manual.

D. GROUND TEST

Engage an independent electrical testing organization to perform the test below.

1. Subject the completed GROUNDING ELECTRODE SYSTEM to a 3-point fail-of-potential ground test according to IEEE 81. Perform the test not less than 2 full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage, and without chemical treatment or other artificial means of reducing natural ground resistance.

Maximum grounding resistance values shall be as listed below:

- a. Equipment Grounding System: 25 ohms.
 - b. Main Service, Grounding Electrode System: 5 ohms.
2. Provide ground test documents signed by the tester and the contractor and issued and approved by the Engineer prior to energizing the power distribution system.

These documents shall clearly show and describe the methods and equipment used in the test and all relevant readings and findings including ground resistance at each test location and observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

These documents shall clearly state whether the system has passed or not passed and show the point(s) where failure occurred. A copy of these signed test results shall be included in the O&M Manual.

3. Where resistance to ground exceeds specified values, notify the Engineer. Check connections of affected equipment and conductors. Replace or repair defective connections or conductors. Provide additional ground rods where the grounding electrode resistance is greater than specified. Revise and repeat testing until resistance is within specifications.
4. These specifications apply to the following Section if it is included in this contract: 16060.

3.10 GENERAL TESTING AND INSPECTION

A. PRIOR TO ENERGIZATION

1. After installing disconnect switches and circuit breakers, perform visual and mechanical inspection of enclosures and devices.
2. Test the equipment and electrical circuits for proper connection, tightness, and absence of undesirable shorts and grounds.
3. Check for continuity, visual damage, marking, and proper phase sequence.
4. Remove any burrs, filings, or other foreign materials from all enclosures; completely wipe down and vacuum.
5. Run a magnet around the bottom of each enclosure and around surfaces that may have collected metal shavings during manufacturing or construction.

B. AFTER ENERGIZATION

1. After electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

2. Correct malfunctioning units on site where possible and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.
3. Test operation, calibration, and settings of the meters, relays, and indicating devices.
4. Test all operating controls for proper operation.
5. Test all auxiliary equipment, i.e., heaters, thermostats, lights, all illuminated indicating devices and lamps, and all audible alarm devices which are an integral part of transformers and panels to verify that they function properly.
6. Check fuses with an ohmmeter. Ring out wiring and busing. Check operation of control and safety interlocks. Check grounding of potential transformers, current transformers, and surge protective devices. Check control connections and tightness at terminal blocks, relays, meters, switches, etc. Tug on each connection to verify a tight connection.
7. Check field connections to field devices, PLCs, and motor starters..
8. Verify proper communication reliability and data transfer speed on local networks.
9. Rework or repair equipment, which performs unsatisfactorily during, or as a result of, testing at no additional expense to the Owner.
10. Additional testing requirements specific to other sections are specified in those sections.

3.11 TEST DOCUMENTS

Test documents, as described above, shall be signed and submitted to Engineering for review prior to energizing associated electrical circuits.

3.12 DEMONSTRATION

Demonstrate to the Owner that the electrical installation is working by operating all electrical systems and equipment. Simulate control and emergency conditions, artificially where necessary, for complete system tests. Demonstrate equipment in accordance with each section in Division 16.

3.13 CLEANING

Clean dirt and debris from all internal and external surfaces. Vacuum out the interior of electrical panels.

Apply touchup paint as required to repair scratches, etc.

Replace nameplates damaged during installation. Thoroughly vacuum the interior of all enclosures to remove dirt and debris.

***** END OF SECTION *****

SECTION 16060

GROUNDING AND BONDING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes grounding of electrical systems, equipment, and basic requirements for grounding, and protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other Sections of these Specifications.

1.2 RELATED WORKS SPECIFIED ELSEWHERE

<u>Sections</u>	<u>Items</u>
01300	Submittals
16050	Basic Electrical Materials and Methods
16120	Conductors and Cables
16130	Raceway and Boxes
WAC 296-46B-250	Grounding and Bonding

1.3 DEFINITIONS

- A. BONDING JUMPER (from NEC 2017, Article 100 - Definitions, Bonding Jumper, Main)

The connection between the GROUNDED CIRCUIT CONDUCTOR and the EQUIPMENT GROUNDING CONDUCTOR at the service.

- B. EQUIPMENT GROUNDING CONDUCTOR (from NEC 2017, Article 100 - Definitions)

The conductive path installed to connect normally non-current-carrying metal parts of equipment together and to the SYSTEM GROUNDED CONDUCTOR or to the GROUNDING ELECTRODE CONDUCTOR, or both. Code requirements associated with equipment grounding is referenced to NEC 250, Section VI – Equipment Grounding and Equipment Grounding Conductors.

- C. GROUNDED SERVICE CONDUCTOR

Also called “utility neutral.” A conductor used to connect the neutral point of the utility transformer to the neutral point of the service entrance.

See SUSE, SYSTEM GROUNDING.

D. GROUNDING ELECTRODE (from NEC 2017, Article 100 - Definitions)

A conducting object through which a direct connection to earth is established.

E. GROUNDING ELECTRODE CONDUCTOR (from NEC 2017, Article 100 - Definitions)

A conductor used to connect the SYSTEM GROUNDED CONDUCTOR or the equipment to a GROUNDING ELECTRODE or to a point on the grounding electrode system.

F. GROUNDING ELECTRODE SYSTEM

See SYSTEM GROUNDING.

G. SUSE

The term SUSE is an acronym for “SUITABLE FOR USE AS SERVICE EQUIPMENT.” It is the point in the electrical grounding system where the SYSTEM GROUNDING CONDUCTORS connect to the EQUIPMENT GROUNDING CONDUCTORS, or the GROUNDED SERVICE CONDUCTOR, or both. For each separately-derived source, this shall occur at the SUSE point. These two points are connected by a BONDING JUMPER.

H. SYSTEM GROUND GRID

The SYSTEM GROUND GRID refers to all portions of SYSTEM GROUNDING. It may be as simple as a pair of ground rods and their associated GROUNDING ELECTRODE CONDUCTORS or a complex ground system with multiple types of GROUNDING ELECTRODES.

I. SYSTEM GROUNDED CONDUCTOR

See GROUNDING ELECTRODE CONDUCTOR.

J. SYSTEM GROUNDING

System Grounding (also referred to as a GROUNDING ELECTRODE SYSTEM) consists of all GROUNDING ELECTRODES, GROUNDING ELECTRODE CONDUCTORS, and associated connecting devices. The GROUNDED SERVICE CONDUCTOR, typically referred to as the

“utility neutral”, is also associated with the system ground. Code requirements associated with system grounding is referenced to NEC 250.50 – Grounding Electrode System.

1.4 SUBMITTALS

Submit under provisions of Section 01300, and Section 16050.

1.5 QUALITY ASSURANCE

See Section 16050.

PART 2 PRODUCTS

2.1 GROUNDING AND BONDING PRODUCTS

Where types, sizes, ratings, and quantities indicated are in excess of National Electrical Code (NEC) requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.

2.2 WIRE AND CABLE GROUNDING CONDUCTORS

Comply with Section 16120.

A. EQUIPMENT GROUNDING CONDUCTORS

1. Insulated Conductors

Color coded green, per section 16120.

2. Sized in compliance with NEC Table 250.122 or as shown on the Plans, whichever is larger.

B. GROUNDING-ELECTRODE CONDUCTORS

1. Bare Conductors

Soft drawn stranded copper meeting ASTM B8.

2. Sized in compliance with NEC Table 250.66 or as shown on the Plans, whichever is larger.

C. **GROUNDING BRAIDS**

1. Copper, manufactured, sized at 26,240 circular mils minimum (#6 AWG equivalent).
2. Certified C22.2, No. 41, Grounding and Bonding Equipment.
3. UL Listings: UL-467 and UL486A.

2.3 GROUND RODS

A. **SIZE AND TYPE**

1. Ground rods shall be 3/4-inch diameter by 10-feet long unless otherwise stated on the Plans.
2. Ground rods shall be copperclad steel rods as follows:
 - a. Heavy uniform coating of electrolytic copper molecularly bonded to a rigid steel core.
 - b. Corrosion resistant bonding between the copper and steel.
 - c. Hard drawn for a scar-resistant surface.

2.4 GROUND ROD BOX

A. **GROUND ROD BOXES**

1. Ground rod boxes shall be “Fogtite Ground Rod Box” or equal.

B. **GROUND ROD BOX LIDS**

1. Ground rods associated with vaults, pullboxes, or handholes that may be subjected to road traffic or heavy loads shall have their ground box lids match the road rating load value of the associated vaults, pullboxes, or handholes.
2. The minimum ground rod box lid shall be rated H20.

2.5 CONNECTOR PRODUCTS

A. COMPRESSION CONNECTORS

1. Compression type for interior locations:
 - a. Standards: UL 467.
 - b. High copper alloy content.
 - c. Non-reversible.
 - d. Terminals for connections to bus bars shall have two bolt holes.
2. Compression type suitable for direct burial in earth or concrete:
 - a. Standards: UL 467, IEEE 837.
 - b. High copper alloy content.
 - c. Non-reversible.

B. BOLTED CLAMPS

1. Standards: UL 467.
2. High copper alloy content.
3. Heavy-duty type.

PART 3 APPLICATION

There are two types of grounding systems covered in this specification;
(1) Grounding Electro Systems and (2) Equipment Grounding Circuits.

1. Grounding Electro Systems shall comply, as a minimum, to the requirements of NEC Sections 250.50 through 250.104, including Table 250.66, "Grounding Electro Conductor for Alternating-Current Systems."
2. Equipment Grounding Circuits shall comply, as a minimum, to the requirements of NEC Sections 250.110 through 250.148, including Table 250.122, "Minimum Size Equipment Grounding Conductors for Grounding Raceway and Equipment."

3.1 GROUND ROD BOX

The connection of Grounding Electrode Conductors to each ground rod shall be accessible through a ground rod box as described herein.

- A. Each ground rod shall be provided with a separate ground rod box which shall provide access to the ground rod, its Grounding Electrode Conductor, and its associated ground clamp.

Exceptions:

- *Ground rod boxes shall not be required if the ground rod is exposed in a manhole, handhole, or seal-off vault as described in this specification.*

- B. Each ground rod box shall be mounted flush to grade.

3.2 GROUNDING ELECTRODE SYSTEMS

Comply with NEC Article 250, Section III for types, sizes, and quantities of Grounding Electrode Conductors, except where specific types, larger sizes, or more conductors than required by NEC are shown on the Plans.

Provide grounding system as shown on the Grounding One Line Diagram of the Plans if provided. When the Plans specifically show, state, or define the method of establishing the SYSTEM GROUND GRID and show the distribution and sizes of the Grounding Electrode Conductors, then these methods shall be followed unless required to be larger by NEC Table 250.66.

A. MANHOLE AND HANDHOLE VAULT GROUNDING

1. Provide a ground rod inside each manhole that contains metal parts.
2. Install grounding around and inside Manholes, Handholes, and Seal-Off Vaults as described in INSTALLATION; MANHOLE AND HANDHOLE, GROUNDING in Part 4 herein.

B. OTHER GROUNDING ELECTRODE DEVICES AND METHODS

1. Hydraulic Piping Systems
 - a. Provide and connect a Grounding Electrode Conductor pigtail to metal hydraulic piping on each major riser.

Connect the conductors to the pipe using NEC-approved hardware and methods.

- b. Provide a ground jumper across both sides of a hydraulic piping electrical insulator to continue ground continuity past the insulator.

Exceptions:

- i. *Unless specifically stated or detailed otherwise on the Plans.*

- c. Ground shall be derived from:

- i. SYSTEM GROUND GRID
- ii. System SUSE connection point.

2. Magnetic Flow Meters

- a. Provide and connect a Grounding Electrode Conductor to the flow meter manufacturer's ground rings as per the manufacturer's recommendations. Provide a #6 AWG ground conductor unless shown otherwise on the Plans.

Exceptions:

- *Unless manufacturer provides documentation verifying that ground rings are not required.*

3. Generators

- a. In addition to the equipment ground provided with the generator feeder, provide a grounding electrode conductor to the generator's neutral terminal sized per the Plans or per NEC Table 250.66, whichever is larger. Treat this conductor as a neutral wire.
- b. Grounding Methods
 - i. The Grounding Electrode Conductor shall be connected to the neutral terminal of the generator as a neutral. This conductor shall be connected to the grounding system at the SUSE bonding connection.

If required to run through a transfer switch, then this neutral wire shall terminate at the transfer switch's isolated neutral bus before continuing to the SUSE bonding point.

- ii. The Equipment Grounding Conductor shall be connected to the metal frame of the generator in compliance with NEC.250.110.

4. Separately Derived Sources

- a. Ground step-down power transformer secondary neutral "XO" terminals to Grounding Electrode Conductors.
 - i. System Ground Grid
- b. Ground step-down power transformer secondary neutral "XO" terminals to Grounding Electrode Conductors.

3.3 EQUIPMENT GROUNDING

Comply with NEC Article 250, Section VI for sizes of Equipment Grounding Conductors, except where specific larger sizes are shown on the Cable and Conduit Schedule in the Plans.

A. EQUIPMENT GROUNDING CIRCUITS

Install insulated Equipment Grounding Conductors with circuit conductors in the manner listed below and in compliance with Code.

- 1. Service and Feeders.

Bond the Equipment Grounding Conductor to the equipment to which the circuit connects and to the raceway if it is metallic.
- 2. Single-phase motor or appliance branch circuits.
- 3. Three-phase motor or appliance branch circuits.
- 4. Flexible raceway runs.

B. EQUIPMENT GROUNDING CONDUCTORS

Equipment Grounding Conductors shall be insulated and color-coded green.

C. ISOLATED GROUNDING-RECEPTACLE CIRCUITS

Install a separate insulated Equipment Grounding Conductor connected to the receptacle grounding terminal. Isolate grounding conductor from raceway and from panelboard grounding terminals. Terminate at the Equipment Grounding Conductor terminal of the applicable derived system or service, except as otherwise indicated.

D. NONMETALLIC RACEWAYS

Install an Equipment Grounding Conductor in nonmetallic raceways unless they are designated for telephone or data cables. Bond the conductor at each end to grounded metallic raceway or equipment.

E. METALLIC RACEWAYS

Install grounding bushings at the end of each conduit and connect to the equipment ground or GROUNDING ELECTRODE SYSTEM.

3.4 FREE-STANDING ELECTRICAL SUPPORT STRUCTURES

Metal support structures used to support electrical equipment, devices, cabinets, panels, or enclosures shall be connected to the GROUNDING ELECTRODE SYSTEM by Grounding Electrode Conductors sized as shown on the Plans or per NEC Table 250.66, whichever is larger. Provide a ground conductor to each vertical support member within 6 inches after rising out of the concrete pad.

PART 4 EXECUTION

4.1 INSTALLATION

A. GROUNDING ELECTRODE CONDUCTORS IN RACEWAYS

1. GROUNDING ELECTRODE CONDUCTORS shall not be installed in metallic raceway. Where required to be in raceway, use PVC-Schedule 80 unless shown otherwise on the Plans. Reference Specification Section 16130.

Ground electrical systems and equipment according to NEC requirements, except where Plans or Specifications exceed NEC requirements.

Coordinate grounding connections made to the water system with the mechanical work and install bonding jumpers wherever deemed necessary.

B. MANHOLE AND HANDHOLE GROUNDING

1. Provide a ground rod inside each handhole that contains metal parts.
2. Expose a minimum of 4 inches of the ground rod above the floor for field inspection and connections to the rod.
3. Connect the manhole/handhole/seal-off vault SYSTEM GROUND GRID to the main SYSTEM GROUND GRID with Grounding Electrode Conductors sized per NEC Table 250.66 unless shown larger on the Plans. The minimum conductor size shall be #6 AWG.
4. Connect the Grounding Electrode Conductor to each metal lid with braided ground conductors of equivalent size and ampacity of the ground ring. Connect braid to metal lids as per manufacturer's recommendations.
5. Connect the Grounding Electrode Conductor to each metal device (conduits, cable tray, j-boxes, support structures, etc.).

4.2 CONNECTIONS

A. GENERAL

Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to assure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to the contact surfaces.

B. EQUIPMENT GROUNDING-WIRE TERMINATIONS

Make the grounding conductor connections to motors or equipment 10 hp and above or 20 amperes and above, with conductor termination and a

5/16 of an inch minimum bolt tapped to the motor frame or equipment housing. Ground connection to smaller motors and equipment may be made by fastening the conductor termination to a connection box.

C. METAL RACEWAY TERMINATIONS

Where metallic raceways terminate at metallic or non-metallic enclosures, panels, or housings, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at both entrances and exits with grounding bushings and bare grounding conductors, except as otherwise indicated.

D. CONNECTION TORQUE

Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. Where these requirements are not available, use those specified in UL 486A and UL 486B.

E. COMPRESSION-TYPE CONNECTIONS

Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by manufacturer of connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

4.3 QUALITY CONTROL

A. TESTS

1. Provide ground testing per Specification 16050, Section 3.

***** END OF SECTION *****

SECTION 16120

CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes building wires, cables, and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.2 RELATED WORKS SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
16050	Basic Electrical Materials and Methods
RCW 19.28.261	Revised Code of Washington, Exemptions from RCW 19.28.161 through RCW 19.28.271
16940	Control Panels

1.3 SUBMITTALS

See Section 01300.

Indicate Field Test Reports and interpret their results for compliance with performance requirements.

1.4 QUALITY ASSURANCE

See Section 16050.

PART 2 PRODUCTS

2.1 BUILDING WIRES AND CABLES

A. STRANDING

1. All power, control, and instrumentation conductors larger than #20 AWG shall be stranded.
2. All equipment ground conductors larger than #16 AWG shall be stranded.
3. All grounding electrode conductors larger than #10 AWG shall be stranded.

B. POWER AND CONTROL WIRE

All power and control wire and conductors in raceways shall be rated 600 VAC.

1. XHHW, XHHW-2

a. Conductor

Class B, stranded, annealed, uncoated copper. Conductors shall comply with:

- i. UL Standard 44.
- ii. ASTM-B3, ASTM-B8, and ASTM-B738.

b. Insulation

Cross-Linked Polyethylene (XLP) High Heat Water Resistant. Insulation shall comply with:

- i. UL-83 Thermoplastic-Insulated Wires and Cables.
- ii. UL-1063 Machine-Tool Wires and Cables.

c. The cable shall meet the following Standards and Agency approvals:

- i. NEMA WC70/ICEA S-95-658.
- ii. ASTM Stranding Class B3, B8, B787
- iii. Federal Specification A-A-59544

C. INSTRUMENTATION, COMMUNICATION, AND NETWORKING CABLES

All instrumentation, communication, and networking cables and conductors in raceway shall be rated 600 VAC.

Exceptions:

- *Telephone cables.*

- *Antenna cables.*

1. Analog Instrument Cables

Paired and triad analog instrument cables shall be #18 AWG stranded tinned copper 600 V tray cable, rated for wet applications at 75 degrees C in a sunlight resistant PVC jacket. Cables shall be plenum and direct burial rated, and shall be provided with individual pair/triad isolated 100 percent foil shields with independent drain wires and an overall isolated shield with drain wire.

These cables shall also be used for totalizing pulse signals from flow meters.

The following cables shall be used for multiple conductor applications:

- a. 2-Conductor, 1 twisted pair, 100 percent overall shield. Belden #9341 or #1120A or equivalent.
- b. 3-Conductor, 1 twisted triad, 100 percent overall shield. Belden #1121A or equivalent.
- c. 4-Conductor, 2 twisted pairs, 100 percent individual shields plus 100 percent overall shield. Belden #1048A or equivalent.

- D. CONTROL AND POWER CABLE/CORDS

1. HVAC Cables

HVAC cables shall only be used as control cables between HVAC equipment and thermostats or other controlling devices.

- a. 4-Conductor, #16 AWG, stranded, 600V, tinned copper, cabled, PVC insulation, and PVC jacket. Belden #8620 or equivalent.
- b. 5-Conductor, #16 AWG, stranded, 600V, tinned copper, cabled, PVC insulation, and PVC jacket. Belden #9620 or equivalent.

2.2 SPLICES, TAPS AND TERMINAL BLOCKS

Splices are only allowed under the conditions of Section 4.2.E.

A. SPLICES TO POWER CONDUCTORS

1. Splices in Outdoor Areas, Handholes, Vaults, or Direct Buried
 - a. For inline butt splices, use inline resin splice kits for non-shielded cables, 600 V; 3M Scotchcast 82-A series or equal. UL listed 486D.
 - b. For odd-shaped and odd sized splices, use multi-mold resin splice kits for non-shielded cables, 600 V; 3M Scotchcast 85-14CP or equal. UL listed 486D
2. Indoor Splices and Taps for Receptacles and Lighting
 - a. Use quick spin, wing torque Electrical Spring and Grounding Connectors; 3M 312, 412, 512, and 512G or equal.
3. Motor Lead Connectors
 - a. Motor terminal connectors shall be insulated multiple tap connectors rated for 600 Vac; N.S.I. Polaris or equal.
4. Power Terminal Blocks
 - a. All power terminals shall be 600 Vac, suitable for 75 degrees C rated copper conductor.
 - b. Power terminal blocks may be copper or aluminum and shall have a short circuit current withstand rating following the guidelines described in UL 1059 and shall meet or exceed the available bolted fault current at the point of application.

B. SPLICES TO CONTROL CONDUCTORS

1. In Junction Boxes and Handholes

Splices to control conductors in junction boxes and handholes shall be made with 600 V, UL486D certified, water-proof direct bury connectors with strain relief, pre-filled with waterproof and

corrosion-proof, non-hardening, silicone dielectric sealant;
DRYCONN DBSR Series or equal.

C. SPLICES TO INSTRUMENTATION CABLES AND CONDUCTORS

1. In Junction Boxes

Strip back the cable outer sheath exposing cable conductors and shield lengths to 1-inch or less. Twist the wires together and solder. Insert and engage into 600 V, UL486D certified, waterproof connectors, pre-filled with waterproof and corrosion-proof, non-hardening, silicone dielectric sealant; DRYCONN Aqua Series or equal.

2. In Pull Boxes and Handholes

Instrument cables and conductors are always passed through a junction box inside pull boxes and handholes. Reference “In Junction Boxes” (above) and Specification 16130, Section 4.

3. Terminal Blocks in Panels

Reference Specification 16940 for terminations in Control Panels.

2.3 INSULATING MATERIALS

A. ELECTRICAL INSULATION PUTTY

3M-Scotchfil, or equal.

B. INSULATING ELECTRICAL TAPE

7 Mil/0.18 mm Plasticized PVC, rubber-based adhesive, 200 percent elongation, 26 N/cm tensile strength, 8 kV breakdown voltage, meeting CE, CSA, UL certifications.

C. CONDUCTOR COLOR-MARKING TAPE

7 Mil/0.18 mm Plasticized PVC, rubber-based adhesive, 200 percent elongation, 26 N/cm tensile strength, 8 kV breakdown voltage, meeting CE, CSA, UL certifications, in required color.

D. ELECTRICAL HEAT SHRINK TUBING

Heat shrink tubing shall be dual-wall polyolefin, 3-1 shrink ratio, 600 Vac, -55 to 110 degrees C operating range meeting UL 224 600V, 125 degrees C.

PART 3 APPLICATIONS

3.1 WIRE APPLICATIONS

A. CABLE AND CONDUIT SCHEDULE

The Cable and Conduit Schedule shall be considered absolute. No changes to wire sizes, wire count, insulation type, or circuit type shall be allowed without approval from the Engineer.

B. WIRES IN RACEWAYS

Wires installed in raceways shall be considered "FIELD" wiring and shall be installed and terminated by qualified and licensed electrical contractors.

Exceptions:

- *Installation and termination may be by the owner under the provisions of "RCW 19.28.261, Exemptions from RCW 19.28.161 through RCW 19.28.271."*
- *If the raceway is installed inside a control panel fabricated by a certified UL 508 shop, then these wires may be installed and terminated per the provisions of WIRES IN CONTROL PANELS as listed below.*

1. Power Wire

a. Insulation

All service, feeder, and branch circuit conductors shall be XHHW-2.

Exceptions:

- *Unless called out otherwise in the Cable and Conduit Schedule.*

2. Class 1 and 2 Control Wire

a. Insulation

All control circuits in raceways shall be XHHW-2.

b. Minimum control wire size in conduits and raceways

The minimum control wire size in conduits and raceways shall be #14 AWG.

C. WIRES IN CONTROL PANELS

Wires in control panels are those that are terminated within a control panel, and do not extend beyond the control panel enclosure. Wires that extend beyond the control panel enclosure shall be installed and terminated per the provisions of “WIRES IN RACEWAYS,” above.

1. Control Panel Power and Control Wire

a. Insulation

Power and control conductors in control panels shall be MTW or THHN/THHN-2.

b. Wires shall have the following minimum sizes and colors:

Circuit Type	Wire Size ⁽¹⁾	Wire Color
120 VAC Power Circuits		
120 VAC, Line	#14 AWG	Black
120 VAC, Neutral	#14 AWG	White
120 VAC, Equipment Ground	#14 AWG	Green
120 VAC Control Circuits		
120 VAC, Line	#18 AWG	Black
120 VAC, Neutral	#18 AWG	White
Low-Voltage AC Control Circuits		
Low-Voltage, Line	#18 AWG	Red
Low-Voltage, Neutral	#18 AWG	White
24 VDC Power Circuits		
+24 VDC Power	#14 AWG	Blue
24 VDC Common	#14 AWG	White with Blue stripe
24 VDC Equipment Ground	#14 AWG	Green

Circuit Type	Wire Size⁽¹⁾	Wire Color
Isolated (Shield) Ground	#12 AWG	Yellow with Green stripe ⁽²⁾
24 VDC Control Circuits		
+24 VDC Control	#18 AWG	Blue
24 VDC Common	#18 AWG	White with Blue stripe
PLC I/O Circuits		
DC I/O	#18 AWG ⁽³⁾	Purple
DC I/O Common	#18 AWG	White with Purple stripe
Analog Inputs	#18 AWG	Analog Instrument Cable ⁽⁴⁾
Analog Outputs	#18 AWG	Analog Instrument Cable

Notes:

- (1) Wire sizes are minimums; size wires to comply with NEC and UL 508.
- (2) Isolated (Shield) ground wires shall be of a color scheme that is approved for ground wires but distinct from equipment grounds.
- (3) For PLC digital outputs, conductors may be #18 AWG between the PLC output terminal and the buffer relay coil when fused at not more than 5A. Wiring from the buffer relay output contacts to field terminals shall be #14 AWG minimum. For retrofit panels without buffer relays, digital output wiring shall be #14 AWG.
- (4) Contractor shall provide one of the Analog Instrument Cables described in the "PRODUCTS" section of this specification.

2. Where panels are required to be manufactured and certified to a particular standard (such as UL 508A), the contractor shall substitute wire colors where required to meet the standard.

PART 4 EXECUTION

4.1 EXAMINATION

Examine raceways and surfaces receiving wires and cables for compliance with requirements for installation tolerances and other conditions affecting performance of wires and cables. Do not proceed with installation until unsatisfactory conditions have been corrected.

4.2 INSTALLATION

A. GENERAL INSTALLATION METHODS

1. Install wires and cables in raceway system, according to manufacturer's written instructions and NECA's "Standard of Installation," after raceway system is complete.

2. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
3. Install cables and conductors neatly in all enclosures. Bend or form wires in neat runs from conduits to terminals. Arrange wires so that they may be grouped by conduit or function in the enclosure. Install cable ties and straps to support and bundle wires in enclosures. Arrange wires to allow wire tags and numbers to be easily read without bending or flexing wiring.
4. Leave 6 inches or more of free conductor at each connected device or equipment terminal and 9 inches of free conductor at each unconnected outlet. Tape free ends of conductors at unconnected outlets and coil neatly in outlet box.
5. Install wiring to equipment neutral and grounding blocks on the bottom or furthest back row first. Leave unconnected blocks accessible for future neutral or grounding connections.
6. Provide individual neutral conductors for each associated circuit. Common neutral conductors for multi branch circuits are not permitted.
7. All power distribution raceways shall contain at least one continuous copper grounding conductor with a minimum size as per NEC 250.122. Larger sizes shall be used if identified in the Cable and Conduit Schedule on the Plans.

B. CONDUCTORS SHARING RACEWAYS

1. Power conductors shall not be run in the same raceway with control conductors.

Exception:

- *Unless specifically shown otherwise in the Cable and Conduit Schedule.*
2. Power conductors shall not be run in the same conduit or raceway with instrumentation cables/conductors.

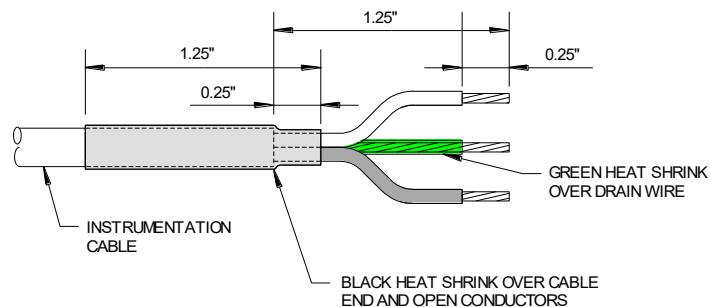
3. Control conductors shall not be run in the same conduit or raceway with instrumentation cables/conductors.

Exception:

- *Unless specifically shown otherwise in the Cable and Conduit Schedule.*

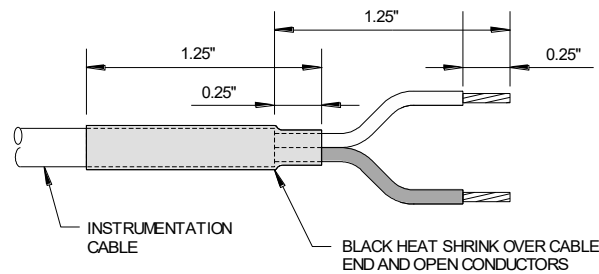
C. INSTRUMENTATION (SIGNAL) CABLES

1. Preparing the Shielded End



- a. Neatly trim the end of the cable.
- b. Strip back 1.25 inch of the outer jacket taking care not to cut into the conductor insulation.
- c. Neatly trim the foil back to the edge of the outer jacket taking care not to damage the drain wire.
- d. For signal cables with a braided shield over a foil shield, carefully cut the braid back to the edge of the outer jacket.
- e. Provide a green heat shrink tube over the drain wire, leaving 0.25 inch of exposed conductor.
- f. Provide a 1.25-inch black heat shrink over the jacket, covering 0.25 inch of the exposed conductors. This properly insulates and protects the ends of the shields and the outer jacket.
- g. Strip the signal conductors exposing 0.25 inch of conductor.

2. Preparing the Unshielded End



- a. Neatly trim the end of the cable.
- b. Strip back 1.25 inch of the outer jacket taking care not to cut into the signal conductor insulation.
- c. Neatly trim the foil back to the edge of the outer jacket.
- d. Cut the drain wire at the edge of the outer jacket taking care not to damage the signal conductor insulation.
- e. For signal cables with a braided shield over a foil shield, carefully cut the braid back to the edge of the outer jacket.
- f. Provide a 1.25-inch black heat shrink over the jacket, covering 0.25 inch of the exposed conductors. This properly insulates and protects the ends of the shields and the outer jacket.
- g. Strip the signal conductors exposing 0.25 inch of conductor.

E. SPLICING CONDUCTORS

1. Install service, feeder, and motor circuits continuous without splices from equipment terminal to equipment terminal or motor lead.

Exceptions:

- *Service entry feeders at weatherheads.*
- *Branch circuits at taps for convenience receptacles and lighting.*
- *As specifically called out.*

2. Install instrumentation and control circuits continuous without splices or terminations from source equipment terminal to destination equipment terminal.

Exceptions:

- *On terminal strips in control panels.*
- *On terminal strips in termination panels.*
- *As specifically called out.*

3. Where splicing is allowed, or specifically called out, install in the following manner:

- a. Splicing Inside Vaults, Handholes, Outdoor J-Boxes, or J-Boxes in Wet Areas

Power and control conductors shall be spliced per Section 2.2.A. Provide a minimum of 24 inches of length on both wires for future re-splicing.

- b. Splicing Inside Motor J-Boxes

Power connections inside motor j-boxes shall be made using insulated multiple tap connectors rated for 600 Vac; N.I.S. Polaris or equal. Cover the splice with a minimum of three layers of black insulating electrical tape. Provide a single band with a minimum of two wraps of the appropriate phase color tape to the entry T-lead. Bend the connections away from the sides of the j-box and motor frame to prevent abrasion from motor vibration.

Control connections inside motor j-boxes shall be made with crimped butt-splices with heat shrink covers. The heat shrink shall overlap the butt barrel ends by a minimum of 1/2 inch on each side. Cover the splice with a minimum of three layers of black insulating electrical tape.

F. REPLACING FAULTY CONDUCTORS

When replacing a faulty conductor or cable that shares a raceway with other conductors or cables, all conductors and cables must be removed and replaced with new.

G. CONDUCTOR LABELLING

All conductors shall be labeled in the following manner.

Exceptions:

- *Conductors supplying power to lighting and convenience receptacles.*
 - *Non-insulated ground conductors.*
 - *At each motor tag for winding lead numbers. Make all phase rotation changes for motor direction changes at the motor to maintain correct color phase sequence in equipment.*
 - *In each enclosure or box where more than one ungrounded power conductor is spliced or connected, tag for panelboard identification and pole number (reference Section 3.3C.).*
1. Conductors shall be labeled the same at each end in a place where the label can be clearly read without moving other wires or rotating the label.
 2. Conductor labels shall reference the device (destination) tag as provided on the "TAG LIST" in the Plans. For example, conductors from panelboard [01 PB 01] to dedicated receptacle [01 DREC 05] shall be labeled as follows:

Line:	01DREC05.L
Neutral:	01DREC05.N
Ground:	01DREC05.G

3. Conductor labels shall each be unique for each circuit. For example, 10 control conductors from Main Control Panel [02 CP 01] (source) to Automatic Transfer Switch [02 ATS 01] (destination) shall be labeled as follows:

Wire #1:	02ATS01.01
Wire #2:	02ATS01.02
Wire #9:	02ATS01.09
Wire #10:	02ATS01.10

4. The labels shall be white heat shrink sized appropriately for the associated conductor with typed lettering in black indelible ink.
5. Label each conductor. When terminating cables, if there is insufficient room to provide a label on each conductor, then label the cable sheath.
6. Tag for phase rotation at each power connection.

Exception:

- *At motor connections.*

H. CONDUCTOR COLORS

1. For conductor colors inside control panels, reference Section 3.1.C.1.
2. Do not use white, gray, green, or green with yellow stripes color for any power, lighting, or control conductor not intended for neutral or equipment grounding purposes.

Exception:

- *Instrumentation and control multi-conductor cables may use white, gray, or green singly or as part of a trace color in addition to the base color.*

3. Equipment grounding conductors: Green or green with yellow stripes.
4. 480/277 volt, 3-phase systems:

Phase A	Phase B	Phase C	Neutral
Brown	Orange	Yellow	Gray

5. 208/120 or 240/120 volt, 3-phase systems:

Phase A	Phase B	Phase C	Neutral
Black	Red	Blue	White

6. 240/120 volt, single phase systems:

Phase A	Phase B	Neutral
Black	Red	White

7. Use wire with insulation of required color for conductors of #6 AWG and smaller. For wire larger than #6 AWG, where not available in specified colors, use conductor color marking tape per Section 2.3.C. When conductors are marked in this manner, mark each conductor at all accessible locations such as panelboards, junction boxes, pullboxes, auxiliary gutters, outlets, switches, and control centers.
8. Connect power conductors of the same color to the same phase throughout the installation. Viewing all equipment from the front, make connections so phase color sequence is in the same order as that for panelboards, switchboards, motor control centers, etc.

I. PULLING CONDUCTORS

1. Instrumentation, Communication, Networking, and Fiber Cables

Make all cable pulls by hand using a manufacturer-approved pulling compound or lubricant where necessary.

2. Power and Control Conductors

- a. Make all cable pulls by hand where possible. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, or wrapping extra conductor into an eye, that will not damage cables or raceway.
- b. On mechanically-assisted pulls use a manufacturer-approved pulling compound or lubricant where necessary. The compound used must not deteriorate the conductors or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values. Install pullboxes where necessary to prevent exceeding manufacturer's recommendations.

3. Cut cable or conductor ends off after pulling and clean all pulling compound from exposed conductors before terminating.

J. CABLE SUPPORTS

Support cables according to Section 16050.

Provide vertical conductor support per NEC Table 300.19(A).

K. WIRING AT OUTLETS

1. Install conductor at each outlet, with at least 6 inches of slack. Connect only to receptacle screw terminals using insulated spade-type lugs.
2. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer, and in compliance with other Sections of Division 16.

4.3 FIELD QUALITY CONTROL

A. TESTING

1. Provide conductor megger testing per Specification 16050, Section 3.

***** END OF SECTION *****

SECTION 16130

RACEWAY AND BOXES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.2 RELATED SECTIONS SPECIFIED ELSEWHERE

<u>Sections</u>	<u>Items</u>
01300	Submittals
02530	Utility Structures
16050	Basic Electrical Materials and Methods
16060	Grounding and Bonding
16120	Conductors and Cables
16140	Wiring Devices

1.3 DEFINITIONS

A. 100 PERCENT CONTINUOUS

100 percent continuous means that electrical continuity shall be maintained over a conduit's entire length and that such conduits shall consist of only RGS (whether PVC-coated or not), LFMC, or combinations of these types. There can be no break in the electrical continuity by non-metallic components.

EMT conduits are not considered 100 percent continuous.

B. CONDUIT BODIES

A separate portion of a conduit system that provides access through a removable cover to the interior of the system at a junction of two or more sections of the system.

C. CONTROL CONDUITS

Control conduits typically contain cables or conductors in the range of 12 Vdc to 120 Vac. These cables/conductors are used to provide discreet field inputs and outputs to motor drives, PLC controllers, operator stations, etc. They typically connect to discreet I/O field devices like local

panel pushbuttons, indicating lights, selector switches, field limit switches, relay circuits, etc.

D. CONTROL PANELS

Control panels are enclosures in which one or more circuits are changed, unlike junction boxes where circuits are simply routed through the panel. Control panels may be as simple as an enclosure with a pilot light or they may be very complicated with hundreds of I/O terminations. For Control Panel considerations, reference Specification 16940.

E. CONVENIENCE RECEPTACLES

Reference Section 16140, Definitions.

F. DEVICE BOXES

Device boxes are electrical boxes used for receptacles, light switches, dimmers, and other similar devices. Selector switches, indicating lights, displays, etc., are mounted in control panels and equipment enclosures, not in device boxes.

G. DRIP FITTINGS

Drip fittings are used to drain water from conduit entry points, junction boxes, or other enclosures where accumulation of moisture must be removed. They are also intended to disable the entry of foreign materials, including tools and fingers, through the drain.

H. DRY LOCATIONS

Reference Section 16050, Definitions.

I. EMT

Electrical Metallic Tubing (a type of RMC).

J. EQUIPMENT VAULT

An Equipment Vault is a VAULT that contains one or more electrical devices that are terminated within the vault; such as flow meters, control valves, control or power panels, lighting, and etc.

SEE VAULTS

K. FINISHED AREAS

Reference Section 16050, Definitions.

L. HANDHOLES

A handhole is a pullbox that is not sufficiently sized for entrance of personnel (reference PULLBOXES).

M. INSTRUMENTATION CONDUITS

Instrumentation conduits contain cables and conductors that carry low-power modulated or communication signals. They may include 4-20 mA current loops, 0–10 volt analog signals, 5 to 12 Vdc digital (TLL) data, analog or digital communications signals, etc. They may also include low-voltage compliance power to instruments such as 5 Vdc, ± 15 Vdc, or 24 Vdc.

N. JUNCTION BOXES

Junction boxes are electrical enclosures used for combining, splitting, pulling, or redirecting electrical circuits. Junction boxes may terminate one conduit or join multiple conduits. Circuits are not *altered* inside a junction box. Enclosures where circuits are altered are called CONTROL PANELS. With the exception of terminal strips, junction boxes do not contain electrical devices.

1. Junction Boxes, Type J1 – not used
2. Junction Boxes, Type J2 – not used
3. Junction Boxes, Type J3

Junction boxes identified as TYPE J3 can contain only instrumentation circuits that are not intrinsically safe.

Junction boxes not containing circuits of the types identified for TYPE J1, TYPE J2, or TYPE J3 are simply called “junction boxes” (without a TYPE identifier).

O. LFMC

Liquid tight Flexible Metal Conduit (a type of RMC).

P. POWER CONDUITS

Power conduits contain branch and feeder conductors with voltages 120 Vac and above. These conductors provide operating power to MCCs, panels, motors, lighting, receptacles, HVAC, etc. Conductors can be of #12 AWG wire gauge and larger, either separate or in power cables.

Q. PROCESS AREAS

Reference Section 16050, Definitions.

R. PULLBOXES

Pullboxes are underground electrical enclosures, sufficiently sized to allow the entrance of personnel, used for combining, splitting, pulling, or redirecting electrical circuits. Pullboxes may terminate one conduit or join multiple conduits. A pullbox can be considered an underground junction box.

Circuits are not altered or terminated inside a pullbox. Pullboxes do not contain electrical equipment or devices.

Exception:

- *Pull boxes may include a sump pump.*

Handholes are types of pull boxes but are not sufficiently sized to allow the entrance of personnel (reference HANDHOLES).

S. PVC

Polyvinyl Chloride Conduit (a type of RNC).

T. PVC-RGS

Polyvinyl chloride, externally coated RGS (a type of RMC).

Alias: May be called or shown on Plans and elsewhere in specifications as PVC-Coated RGS or PVC-RMC.

U. PVC-RMC

Reference PVC-RGS.

V. RGS

Rigid Galvanized Steel (a type of RMC).

W. RMC

Rigid Metal Conduit (General NEC Category).

X. RNC

Rigid Nonmetallic Conduit (General NEC Category).

Y. SURFACE RACEWAYS

A metallic raceway that is intended to be mounted to the surface of a structure, with associated couplings, connectors, boxes, and fittings for the installation of electrical conductors.

Z. VAULTS

A vault is an underground structure, serviceable or accessible only from the top. Handholes, Equipment Vaults, and Pullboxes are considered vaults.

AA. WET LOCATIONS

Reference Section 16050, Definitions.

BB. WIREWAYS

Sheet metal troughs with hinged or removable covers for housing and protecting electric wires and cable in which conductors are laid in place after the wireway has been installed as a complete system.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Provide data for surface raceways, wireways and fittings, hinged-cover enclosures, and cabinets.

1.5 QUALITY ASSURANCE

See Section 16050.

1.6 COORDINATION

Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

Coordinate electrical work with outside utilities associated with the project.

Non electrical piping and structural has priority over underground conduit routing.

Exception:

- *Unless specifically coordinated otherwise with the General Contractor.*

PART 2 PRODUCTS

2.1 METALLIC CONDUIT TYPES

A. EMT

1. Conduit

Galvanized steel tubing meeting ANSI C80.3.

2. Conduit bodies shall be galvanized, or epoxy coated cast iron or aluminum one piece with galvanized, or epoxy coated cast cover, gasket, and threaded hubs. Use stainless steel screws or other approved non-corroding screws to hold cover in place.

3. EMT connectors shall be compression type only. Set screw connectors shall not be allowed.

4. Conduit clamps for EMT shall be stamped galvanized steel.

B. FMC

1. Conduit

Flexible, galvanized steel convolutions forming a continuous raceway.

2. Connectors

Galvanized steel, screw in, approved for grounding.

C. LFMC

1. Conduit

Flexible, galvanized steel convolutions forming a continuous raceway, covered by a liquid tight PVC layer. Electri-Flex Type LA or American Sealtite, Type UA

2. Connectors

Galvanized steel, screw in, grounding type with a ferrule, which covers the end of the inside and outside of the conduit.

D. RGS

1. Conduit

Hot dipped galvanized with threaded ends meeting ANSI C80.1.

2. Couplings

Steel, cast iron, or malleable iron compression type employing a split, corrugated ring and tightening nut, with integral bushings and locknuts. No indent or set screw type.

a. Couplings

Unsplit, NPT threaded steel cylinders with galvanizing equal to the conduit.

b. Nipples

Factory made through 8 inches, no running threads.

c. Conduit bodies shall be galvanized, or epoxy coated cast iron or aluminum one piece with galvanized, or epoxy coated cast cover, gasket, and threaded hubs. Use stainless steel screws or other approved non-corroding screws to hold cover in place.

3. Conduit Clamps

Conduit clamps for RGS shall be cast iron.

E. PVC-COATED RGS, PVC-RMC

1. General

- a. A proprietary-colored urethane coating shall be uniformly and consistently applied to the interior of all conduit and fittings. This internal coating shall be a nominal 2 mil thickness. Conduit or fittings having areas with thin or no coating shall be unacceptable.
- b. The PVC exterior and urethane interior coatings applied to the conduit shall afford sufficient flexibility to permit field bending without cracking or flaking at temperatures above 30 degrees F (-1 degrees C).
- c. All male and female threads on conduit, elbows, and nipples shall be protected by application of an electronically conducting corrosion resistant compound.
- d. Installation of the PVC coated conduit system shall be performed in accordance with the manufacturer's installation manual.
- e. Conduits and fittings shall meet the following standards:
 - i. ASTM D870
 - ii. ASTM D1151
 - iii. ASTM D3359
 - iv. ASTM D1308
 - v. NEMA RN1

2. Conduit

- a. The PVC coated rigid metal conduit must be UL listed. The PVC coating must have been investigated by UL as providing the primary corrosion protection for the rigid metal conduit. Ferrous fittings for general service locations must be UL listed with PVC as the primary corrosion protection. Hazardous location fittings, prior to plastic coating must be UL listed. All conduit and fittings must be new, unused material. Applicable UL standards may

include: UL 6 Standard for Safety, Rigid Metal Conduit, UL 514B Standard for Safety, Fittings for Conduit and Outlet Boxes.

- b. The conduit shall be hot dip galvanized inside and out with hot dipped galvanized threads.

3. Fittings and Accessories

The design shall be equipped with a positive placement feature to ease and assure proper installation. Certified results confirming seal performance at 15 psig (positive) and 25 inches of mercury (vacuum for 72 hours shall be available).

- a. A PVC sleeve extending one pipe diameter or 2 inches, whichever is less, shall be formed at every female fitting opening except unions. The inside sleeve diameter shall be matched to the outside diameter of the conduit.
- b. The PVC coating on the outside of conduit couplings shall have a series of longitudinal ribs 40 mils in thickness to protect the coating from tool damage during installation.
- c. Conduit Form 8 Bodies shall be 1/2 inch through 2-inch diameter, shall have a tongue-in-groove "V-Seal" gasket to effectively seal against the elements. Conduit bodies shall be Form 8 and shall be supplied with plastic encapsulated stainless steel cover screws.
- d. Right angle beam clamps and U bolts shall be specially formed and sized to snugly fit the outside diameter of the coated conduit. All U bolts will be supplied with plastic encapsulated nuts that cover the exposed portions of the threads.
- e. Conduit clamps and fittings for PVC-Coated RGS conduits shall be 316L stainless steel.

4. Approved Material

- a. Plasti-Bond REDH2OT, Perma-Cote, or KorKap manufactured by Robroy Industries.
- b. Ocal-Blue Steel conduit and fittings as manufactured by Ocal, Inc.

- c. Any deviation from the above approved materials must be approved by the Engineer.

2.2 NONMETALLIC CONDUIT TYPES

A. PVC

1. Conduits

NEMA TC 2, Schedule 40 or 80 PVC.

2. Fittings and Accessories

NEMA TC 3; match to conduit type and material, but elbows shall be RMC.

3. Conduit bodies

Where allowed, shall match type, material, and gauge of conduit.

2.3 OUTLET AND DEVICE BOXES

A. STANDARD METAL BOXES

Assembled from stamped steel hot dipped zinc galvanized coated flat pieces, welded or mechanical assembled into a device box, with knockouts for conduit or connector entrance, meeting NEMA OS 1, with plaster or extension rings and necessary mounting appurtenances to suite construction and application.

B. CAST BOXES

1. Cast Aluminum

Epoxy coated cast aluminum box, one piece, with mounting lugs, with threaded holes or hubs, with internal green ground screw and with neoprene gaskets.

2. Cast Iron

Cast iron with electro-galvanized and aluminum acrylic paint finish, one piece, with mounting lugs, with threaded holes or hubs, with internal green ground screw and with neoprene gaskets.

C. **DEVICE COVERS**

1. Plastic: Thermoplastic nylon, device-mount, ivory.
2. Aluminum: Sheet Aluminum.
3. Cast Iron: Iron alloy.

D. **SWITCH ACTUATORS**

1. Aluminum: Lever-arm type, raintight, cast aluminum matching the metallurgy of the device box.
2. Cast Iron: Lever-arm type, raintight, cast iron alloy matching the metallurgy of the device box.

E. **WEATHERPROOF COVERS AND PLATES**

Weather proof, self-closing, die-cast aluminum, UL listed.

F. **IN-SERVICE COVERS**

Shall be weather proof and hinged from top with removable cord slots.

2.4 JUNCTION BOXES, HANDHOLES, AND VAULTS

A. **JUNCTION BOXES**

1. Standard

Stamped steel, deep drawn one piece (without welds or tab connections), galvanized, with knockouts for conduit or connector entrance, meeting NEMA OS 1. Boxes 6" x 6" x 4" or larger may be code gauge fabricated steel continuously welded at seams and painted after fabrication.

2. Cast

Cast iron with electrogalvanized and aluminum acrylic paint finish, one piece, with threaded cover of the same metallurgy and finish, with mounting lugs, with threaded holes or hubs, with internal green ground screw and with neoprene gaskets; explosion-proof, dust-ignition-proof, raintight, rated for Class I, Division 1 and 2, Groups C, D.

3. Stainless Steel

NEMA 4X 316L stainless steel with gasketed screw down cover.

B. HANDHOLES

1. Material and Strength

Handholes shall be made from Concrete or Polymer Concrete. The boxes and covers are required to conform to all test provisions of ANSI/SCTE 77 2002 "Specification for Underground Enclosure Integrity" for Tier 15 applications (Design Load Vertical 22,500 lbs. and Lateral 800 lbs/sq. ft.) and to be Listed and Labeled. The boxes must physically accommodate and structurally support compatible covers, which possess the Tier rating. In no assembly can the cover design load exceed the design load of the box. All components in an assembly (box and cover) are to be manufactured by the same manufacturer. All covers are required to have a minimum coefficient of friction of 0.50 in accordance with ASTM C1028. Independent third-party verification or test reports stamped by a registered Professional Engineer certifying that all test provisions of this specification have been met are required with each submittal. The cover is to have an identifying function descriptor imprinted on it. The Descriptor shall be ELECTRICAL, CONTROL, SIGNAL, TELEPHONE, STREET LIGHT, or similar approved by the Engineer.

Handholes with metallic lids shall be grounded per Specification Section 16060.

Handhole lid assemblies comprised of steel shall have a factory-applied galvanized finish.

2. Manufacturers

Quazite (Strongwell Corp.)
Carson Industries

PART 3 APPLICATION

3.1 CONDUIT BODIES

This section describes the types of raceways, junction boxes, and device boxes that can be used for different circuits and different environments. Reference Section 4.1 for methods and practices required for installation.

A. CABLE AND CONDUIT SCHEDULE

The Cable and Conduit Schedule shall be considered absolute. No changes to wire sizes, wire count, insulation type, circuit type, or conduit size shall be allowed without approval from the engineer.

The Cable and Conduit Schedule does not indicate conduit type (PVC, EMT, RGS, etc.) since, in many cases, a conduit's type may change between its source and destination. The rules stated in this specification define the necessary and allowed conduit type(s) for various applications and routes.

B. RACEWAY REQUIREMENTS

The term "RGS conduits" refers to a type of conduit body and does not imply whether the conduit is PVC-coated or not. Certain applications require RGS conduits with PVC coating, others do not. Reference Section 3.2, "RGS RACEWAY PROTECTIVE COATINGS" for these requirements.

1. Circuit Types and Categories

a. Circuit Types

Conduits are broken into three general circuit types; 1) Power, 2) Control, and 3) Instrumentation (see Definitions).

On the Cable and Conduit Schedule, Power conduits are those starting with the letter "P", Control conduits are those starting with the letter "C", and Instrumentation conduits are those starting with the letter "S".

b. Circuit Categories

Power circuits are broken into two categories, those that contain linear loads and those that contain non-linear loads (see Definitions).

Control and Instrumentation circuits are broken into two categories, those that contain intrinsically safe circuits and those that do not (see Definitions).

These types and categories are listed below in Table 3.1.B.1 below.

c. Relationships Between Circuit Categories and Conduit Types

Many electrical circuit types do not require special conduit routing considerations. However, Table 3.1.B.1 shows the circuit types where the conduit route must be 100 PERCENT CONTINUOUS (reference Definitions).

Table 3.1.B.1

Type	100% Continuous?
Power	No
Control	No
Instrumentation	Yes

2. Conduit Shape

Wiring shall be routed in pipe or tubular conduits, NOT in fabricated wireways or gutters.

C. PVC SCHEDULE 40 RACEWAY APPLICATIONS

1. All straight portions of conduits completely concealed in walls, attics, concrete, or below ground (not exposed) shall be PVC Schedule 40.

Exceptions:

- *All Instrumentation conduits shall be 100 percent continuous over their entire length.*
- *All conduits containing grounding electrode conductors shall be PVC Schedule 80 over their entire length.*
- *PVC conduit areas under roads or heavy traffic areas shall be Schedule 80.*
- *Where specifically called out otherwise in the Cable and Conduit Schedule.*

2. All portions of power and control conduits completely concealed inside a reservoir shall be PVC Schedule 40.

D. PVC SCHEDULE 80 RACEWAY APPLICATIONS

1. All portions of conduits which contain grounding electrode conductors shall be PVC Schedule 80 and shall contain no metal fittings, connectors, or devices. Such conduits containing grounding electrode conductors shall contain no other types of conductors.
2. PVC conduit areas under roads or heavy traffic areas.
3. As stated in the Cable and Conduit Schedule.

E. RGS RACEWAY APPLICATIONS

1. All conduits requiring 100 percent continuity per Section 3.1.B.1 shall be RGS over their entire length. For coating requirements, reference Section 3.2.

Exception:

- *LFMC conduit shall be allowed per the “LFMC Raceway Applications” section herein.*

2. Underground factory or bent elbows and offsets greater than or equal to 30 degrees shall be RGS.

Exceptions:

- *Where the radius of a conduit bend is greater than or equal to 15 feet per inch of trade size.*
- *Raceways used for the containment and protection of bare grounding electrode conductors shall be PVC Schedule 80. Reference PVC Schedule 80 raceway applications.*

3. All portions of conduits exposed outdoors shall be RGS.

Exception:

- *All conduits containing grounding electrode conductors shall be PVC Schedule 80 over their entire length.*

4. All portions of conduits under covered structures open on any side shall be RGS.

Exception:

- *All conduits containing grounding electrode conductors shall be PVC Schedule 80 over their entire length.*
 - *LFMC conduit shall be allowed per the “LFMC Raceway Applications” section herein.*
5. All portions of conduits exposed on the inside of below-ground pullboxes, equipment vaults, wet wells, and dry wells (vaults) shall be RGS.
 6. All portions of conduits penetrating concrete floors, walls, or ceilings shall be RGS.
 7. All conduit penetrations from grade shall be RGS.

Exception:

- *All conduits containing grounding electrode conductors shall be PVC Schedule 80 over their entire length.*
8. All portions of exposed conduits inside closed buildings shall be RGS.

Exceptions:

- *EMT conduit shall be allowed per the “EMT Raceway Applications” section herein.*
- *LFMC conduit shall be allowed per the “LFMC Raceway Applications” section herein.*
- *All conduits containing grounding electrode conductors shall be PVC Schedule 80 over their entire length.*

F. LFMC RACEWAY APPLICATIONS (REFERENCE DEFINITIONS)

1. LFMC conduit shall be used for the last 18 inches of connection to motors, transformers and other vibrating equipment.
2. LFMC conduit shall be used for the last 18 inches of connection to any device that may require minor movement during maintenance or repair or that may require physical adjustment.

G. EMT RACEWAY APPLICATIONS (REFERENCE DEFINITIONS)

1. EMT conduits may be used in attics and where concealed in walls.

Exception to the use of EMT:

- *Where conduit is required to 100 percent continuous.*

3.2 RGS RACEWAY PROTECTIVE COATINGS

Protected RGS conduits are used to minimize conduit degradation from moisture and chemicals.

Where called in the Plans or Specifications as “Protected RGS,” “PVC-Coated RGS,” “PVC-Coated,” “PVC-RGS,” or “PVC-RMC,” all such conduits, elbows, and fittings shall be factory coated PVC as defined in Section 2.1.

A. PVC-COATED RGS CONDUIT APPLICATIONS

1. All portions of RGS elbows, bends, straight pipes, couplings, and fittings buried underground shall be PVC-Coated.
2. All portions of RGS elbows, bends, straight pipes, couplings, and fittings encased in concrete shall be PVC-Coated.
3. All portions of RGS elbows, bends, straight pipes, couplings, and fittings exposed outdoors shall be PVC-Coated.
4. All portions of RGS elbows, bends, straight pipes, couplings, and fittings inside underground vaults, pullboxes, wet wells, and dry wells shall be PVC-Coated.
5. All portions of RGS elbows, bends, straight pipes, couplings, and fittings exposed in Chemical Rooms (reference Definitions) shall be PVC-Coated.
6. All portions of RGS conduits penetrating concrete floors and below-ground walls and ceilings shall be PVC-Coated at least 12" into the exposed area and extending at least 24" underground.

Exceptions:

- *Where specifically noted to be otherwise in the Plans.*

- *Non-metallic conduits that terminate at the wall of a pullbox.*

3.3 JUNCTION AND DEVICE BOX APPLICATIONS

A. JUNCTION BOXES

1. Junction boxes for Instrumentation, Intrinsically Safe, and Non-Linear Power circuits (see Definitions) shall be hinged steel, 6" x 6" x 4" minimum.
2. Dry Areas (see Definitions).
 - a. Flush-mounted junction boxes may be the standard type.
 - b. Wall-mounted junction boxes shall be the NEMA 1 gasketed.
3. Wet Areas (see Definitions).
 - a. NEMA 3R cast aluminum or stainless steel.

B. DEVICE BOXES, ACTUATORS, AND COVERS

All exposed boxes shall be of cast construction.

All aluminum and cast iron covers shall be provided with a weatherproof gasket.

1. Outdoors, In Pullboxes, In Equipment Vaults
 - a. Receptacles

Cast iron device box body with cast aluminum gasketed cover and top-opening "in-service" cover.
2. Indoor, Wet Areas (see Definitions).

Boxes mounted in Concrete Masonry Unit (Block) walls shall be Masonry type boxes.

- a. Receptacles
 - i. Surface-mounted – cast aluminum device box body with gasketed die cast aluminum, snap-action, weatherproof cover.
- b. Light Switches
 - i. Surface-mounted – die cast aluminum device box body with gasketed cast aluminum switch cover.

3.4 HANDHOLE APPLICATIONS

A. HANDHOLES

Handholes are used as pull and splice points in underground installations and are typically installed in driveways, parking lots, and off-roadway applications subject to occasional non-deliberate heavy vehicular traffic.

1. Handholes shall be set adjacent to each pole light pedestal.

Exception:

- *Unless specifically shown or called out otherwise on the Plans.*

PART 4 EXECUTION

4.1 EXAMINATION

Examine surfaces and spaces to receive raceways, boxes, for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

4.2 INSTALLATION, GENERAL

A. COORDINATION WITH OTHER WORK

Wherever practical, route conduit with adjacent ductwork or piping.

1. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes or other heat sources operating at temperatures above 100 degrees F.

2. When installing utility conduits, comply with the spacing and depth requirements of the utilities.
3. Non-electrical buried piping has routing priority over electrical burials.

B. MOUNTING PRACTICES

1. All conduits in process areas shall be surface mounted unless specifically called out otherwise on the Plans.
2. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.
3. Where several conduits follow a common route, stagger pull boxes, junction boxes, pulling sleeves, and fittings.

C. DEVICE BOX INSTALLATION

1. Coordinate box locations with building surfaces and finishes to avoid bridging wainscots, joints, finish changes, etc.
2. Recess boxes in the wall, floor, and ceiling surfaces in finished areas. Set boxes plumb, level, square and flush with finished building surfaces within 1/16 of an inch for each condition. Set boxes so that box openings in building surfaces are within 1/8 of an inch of edge of material cut-out and fill tight to box with building materials. Back boxes with structural material to prevent rotation on studs or joists. Use gang boxes wherever more than one device is used at one location.
3. Surface mount boxes to building structures with a minimum of 1/4-inch spacing and with a minimum of two fasteners. Provide attachments to withstand an additional force of 100 pounds applied vertically or horizontally.
4. Set recessed boxes at the following heights to the bottom of the box, except where noted otherwise in the Plan Set:
 - a. Convenience outlet receptacles in finished areas at 18 inches above floor.
 - b. Lighting switches, dimmers, etc., at 42 inches above floor.
 - c. Wall mounted telephones at 60 inches above floor.

5. Set surface-mounted receptacle and lighting boxes in wet areas 42 inches above the finished floor to the center of the box, unless called out otherwise in the Plan Set.
6. Set surface-mounted boxes for lighting switches within 12 inches of the door opening on the strike or lock side of the door or on the side closing last unless indicated otherwise in the Plan Set.
7. Arrange boxes used in wet areas to drain moisture away from devices or enclosures for equipment and make conduit connections from below.
8. Set floor boxes level and adjust to finished floor surface.

D. CONDUIT INSTALLATION

Install conduit as a complete and continuous system without wires. Mechanically secure to boxes, fittings, and equipment. Electrically connect conduits to all metal boxes, fittings, and equipment.

1. All field or manufactured ferrous metal threaded connections of conduits and fittings shall be installed with a coating of electrically conductive, corrosion resistant, copper colloidal compound such as “Shamrock Kopr-Shield™ Compound” or equivalent.
2. Keep conduits clean and dry. Close each exposed end.
3. Properly ground each metallic box, cover, lid, hatch, conduit, etc., in compliance with the National Electrical Code and Specification Section 16060.
4. When blowing through conduits, cover electrical components installed in enclosures to avoid blowing dirt, shavings, or moisture into equipment.
5. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel, monofilament plastic line, or woven polyester pull line with not less than 200-lb tensile strength. Leave at least 8 inches of slack at each end of the pull wire.
6. Install exposed raceways in lines parallel or perpendicular to the building or structural member’s lines except if structure is not level then follow the surface contours as much as practical. Do not

crossover or use offsets if they can be avoided by installing the raceway in a different routing.

7. Run parallel or banked conduits together, on common supports where practical.
8. Make bends in parallel or banked runs concentric (common radius point, expanding radius). Use factory elbows only where elbows can be installed concentrically; otherwise, provide field bends for parallel raceways.
9. Select surface raceway outlet boxes to which lighting fixtures are attached of sufficient diameter to provide a seat for the fixture canopy.
10. Provide surface metal raceway outlet box and the backplate and canopy at the feed-in location of each end-stem suspension fluorescent lighting fixture.
11. Labeling

With the exception of conduits supplying power to lighting and convenience receptacles, all conduits shall be labeled in the following manner.

- a. Conduits shall be labeled at each entrance and exit of a raceway, box, and device. Labels shall be placed no more than 3 inches from the relevant entrance or exit and shall be positioned in a manner where they can best be read by technicians and maintenance personnel.

Exception:

- *Only one label shall be required for conduits less than 6 feet in length where the entire conduit can be seen from a single point.*
- b. The labels used shall be permanent items manufactured specifically for tagging conduits in direct sunlight and wet environments.
 - c. The conduit label shall be the full conduit number as listed on the Cable and Conduit Schedule.

- d. The conduit label shall be attached near the ends of conduit stub ups through floors and penetrations into vaults even if equipment is set over the conduit.

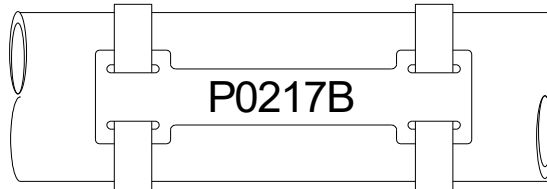


Figure 4.2.D.11

Example of a Conduit Label

E. RACEWAY TERMINATIONS AND CONNECTIONS

1. Join raceways with fittings designed and approved for the purpose and make joints tight.

2. Make connections waterproof and rustproof by application of a watertight, conductive thread compound. Clean threads of cutting oil before applying thread compound.

3. PVC–RMC Conduits

Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.

4. Apply PVC adhesive by brush.

5. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.

6. Cut ends of conduit square with hand or power saw or pipe cutter. Ream cut ends to remove burrs and sharp ends. Make conduit threads cut in the field with the same effective length and same thread dimensions and taper as specified for factory-cut threads.

7. Flexible Connections

Use maximum of 18 inches of flexible conduit for equipment subject to vibration, noise transmission, removal, or movement; and for all motors. Do not use flexible conduit in place of elbows, offsets, or fittings to attach to fixed equipment. Recessed and

semirecessed lighting fixtures may use up to 6 feet of flexible conduit, or 11 feet of premanufactured lighting “whips.” Use LFMC in wet or damp locations. Do not strap flexible conduit to structures or other equipment.

8. Provide double locknuts and insulating bushings at conduit connections to boxes and cabinets. Align raceways to enter squarely and install locknuts with dished part against the box. Use grounding type bushings where connecting to concentric or eccentric knockouts.

Exception:

- *In wet areas, use Myers hubs.*

9. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.
10. Support conduit connections to motors or other equipment independently of the motor or equipment. Raise or drop vertically to the nearest practicable point of connection to the unit. Run vertical drops to the floor and fasten with a floor flange. Unsupported drops are not permitted. Horizontal runs on the floor or on equipment are not permitted. Drop or raise at the appropriate closest location. Run conduit on equipment frames or supports to closely follow the contours of the equipment. Locate conduit to maintain access to all equipment services and adjustment points and so as not to interfere with operation of the equipment.
11. Connect conduit to hubless enclosures, cabinets, and boxes with double locknuts and with insulating type bushings. Use grounding type bushings where connecting to concentric or eccentric knockouts. Make conduit connections to enclosures at the closest point possible where the devices are located to which the circuits contained in the conduit will connect.

Exception:

- *In wet areas, connect to enclosures, boxes, and devices from the bottom side using Myer-type hubs.*

F. RACEWAY SUPPORT

Support raceways as specified in Section 16050.

1. Provide anchors, hangers, supports, clamps, etc., to support the raceways from the structures in or on which they are installed. Do not space supports further apart than 10 feet.
2. Provide sufficient clearance to allow conduit to be added to racks, hangers, etc., in the future.
3. Support raceway within 3 feet of every outlet box, junction box, panel, fitting, etc.
4. Support raceway and boxes in an approved manner by:
 - a. Expansion shields in concrete or solid masonry;
 - b. Toggle bolts on hollow masonry units;
 - c. Wood screws on wood;
 - d. Metal screws on metal.
5. Raceway in wet areas shall have clamp backs or other appropriate spacers to hold them a minimum of 1/2 inch off the surface. Horizontal runs on the roof surface shall be blocked at every 5 feet to hold them a minimum of 2 inches above roof surface.

G. INSTALLING PVC-COATED RGS CONDUITS

1. Follow the manufacturer's requirements and recommendations when installing PVC-Coated RGS conduits.
2. Seal the connections to protect the conduit.
3. Provide manufacturer's PVC repair compound where the thickness of the conduit coating has been reduced or damaged (from bending, threading, nicking, etc.)

H. BENDS AND OFFSETS

1. Fabricated bends and offsets shall be made with manufacturer-approved bending tools, by manufacturer-certified personnel.

2. Where possible, use standard elbows, conduit fittings, or junction boxes to avoid fabricated bends.
3. Make bends and offsets uniform and symmetrical. Make bends and offsets so that the inner diameter is not reduced. Use expanding plugs for bends in PVC conduit of 2-inch trade size or larger. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

I. PENETRATIONS FOR RACEWAYS

1. Do not bore holes in floor and ceiling joists outside center third of member depth or within 2 feet of bearing points. Holes shall be 1-inch diameter maximum.

Exception:

- *Unless specifically approved by Structural Engineer.*
2. Penetrate through roofs with core drill hole 1/2 to 1 inch larger than conduit, flash with neoprene, caulk conduit in place and seal with silicone sealant under flashing. Sleeve roof opening where non-concrete roof construction occurs.

4.3 HANDHOLES

A. HANDHOLE INSTALLATION

Install handholes for underground raceway systems true to line and grade. Provide a compacted foundation of fine sand or 3/8 minus crushed rock for the bearing surface edges of the handholes.

The handholes shall be installed per the NEC sections 314, and other applicable sections of the NEC.

B. HANDHOLE CONDUIT INSTALLATION

1. End all conduits with a vertical riser.
2. Conduits NOT identified as 100 percent continuous shall be allowed to extend into the handhole as a PVC conduit. Provide a PVC bell-end in each conduit as shown in Figure 4.5.B.2. Provide a removable filler at the end of each conduit to eliminate the possibility of water entry.

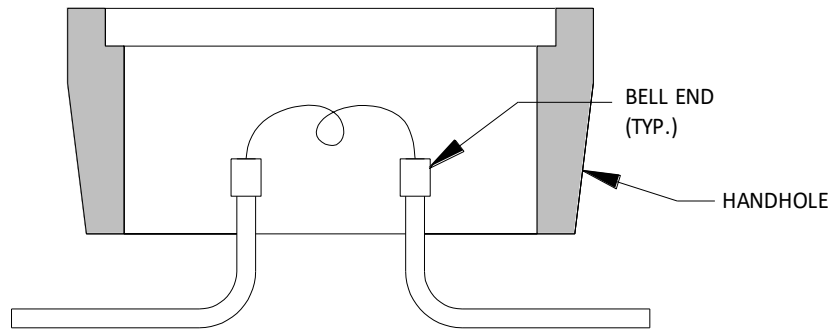


Figure 4.5.B.2

Typical PVC Conduit Terminations in a Handhole

3. Conduits identified as 100 percent continuous shall terminate into the bottom of a TYPE J1, TYPE J2, or TYPE J3 junction box, with Myer-type hubs, in PVC-Coated RGS conduit as shown in Figure 4.5.B.3. The door of the J-Box shall face upwards.

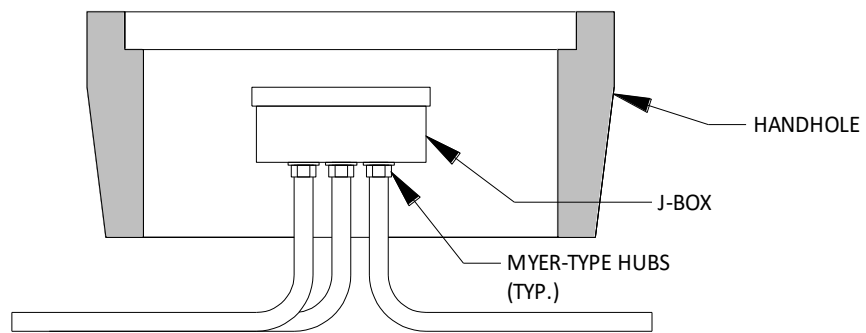


Figure 4.5.B.3

Typical 100 Percent Continuous Conduit Terminations in a Handhole

Exception:

- *Where a handhole contains only two conduits, and is being used solely as a pulling point, where one conduit is simply an extension of the other, a junction box may be replaced with a PVC-Coated RGS conduit pulling body.*

C. HANDHOLE GROUNDING

1. All handholes with metal conduits or with metal lids shall be grounded per Section 16060-3.

4.4 INSTALLATION OF CONDUITS UNDERGROUND AND IN CONCRETE

A. UNDERGROUND RACEWAYS

1. The minimum conduit depth shall be 24 inches.

Exceptions:

- *Electrical utility conduit depth shall be 36 inches.*
 - *Unless required otherwise by utility company.*
 - *Unless required to be shallower due to physical constraints (see requirements below).*
 - *Unless under a concrete slab (see requirements below).*
 - *Conduits containing a grounding electrode conductor shall be 30-inches deep.*
2. Conduits that require a buried depth of less than 18 inches shall require a 6-inch-thick concrete covering over that portion of such conduits. Such concrete covers need not be formed but shall be colored red or shall be painted red on top.
 3. Conduits under a concrete slab-on-grade shall be separated from the slab and from the supporting soil by at least 3 inches with soft sand on all sides.
 4. Provide separation of underground instrumentation conduits from power and control conduits by a minimum of 12 inches. Avoid parallel runs of instrumentation conduits with power and control conduits as much as possible. Where instrumentation conduits are required to crossover power or control conduits, maintain the 12-inch separation using depth and make the crossover as close to 90 degrees as possible.

5. Run conduits as straight as practicable. Make changes in direction and/or grade of sufficient length to allow a gradual change (3-foot radius minimum). Make slight offsets with 5-degree couplings.
6. Run trenches true and clear of stones or soft spots. Place 4-inches of fine sand in the trench bottom and tamp into place. Provide preformed plastic spacers on top of sand spaced 5-feet on center.

After the raceway is placed in the trench, backfill 6 inches with sand, then with native earth backfill passing a No. 8 sieve, free of stones. Do not tamp on top of the conduit until the final backfill is placed. Tamp or water-settle the final backfill to finish the grade. Compact the backfill as specified under Section 02300 "Site Earthwork."
7. Mark direct buried conduit by placing a red marking tape a minimum of 12 inches below grade during backfilling of the trench.
8. Seal conduit connections to eliminate leakage.

B. CONCRETE ENCASED RACEWAYS

Raceways encased in structural concrete must be defined in detail and presented to the Structural Engineer for approval at least 7 days prior to installation. As a minimum, approval will be based on the assurance that there will be no physical interference and that structural integrity will not be jeopardized.

1. In general, conduits encased in concrete may take the most direct route providing they do not jeopardize the structural integrity of the slab or interfere with process-related piping or equipment.
2. Conduits shall be at least 1-1/2 inches to the edge of a concrete body. If a structural block-out is desired for conduit bundling near the edge of a concrete body, then submit the desired layout to the Engineer for approval and design as defined in this Section.
3. Conduit density, crossover, and routing must be minimized and coordinated to assure that structural integrity is not jeopardized.
4. At the point-of-exposure out of the slab, conduits must be perpendicular to the slab surface from all angles.

5. No part of an elbow's bending radius shall be seen at the point-of-exposure from the slab.

C. CONDUITS IN ELEVATED SLABS

See "CONCRETE ENCASED RACEWAYS" above.

D. CONDUITS UNDER SLABS ON GRADE

1. No conduits will be encased in slabs less than 8 inches in depth.
2. For slabs-on-grade, all conduits larger than 3/4-inch trade size must be run underground below the slab.
3. All conduits desired to be installed within slabs on grade shall be submitted to the Engineer for approval and design as defined in this Section.

E. CONDUIT TRANSITIONS

Where raceway exits from grade or concrete, provide the following:

1. Only the straight portion of conduits shall exit grade or concrete. No curved portion of a factory or field-bent conduit shall be visible existing the penetration, even when covered or hidden by equipment.

F. CONDUIT STUB-UPS INTO EQUIPMENT AND ENCLOSURES

1. Where conduits are stubbed up into open bottom equipment and enclosures, extend the bottom of the conduit threads 1/2 inch above grade. Provide ground bushing and end fittings, flush with fitting and 2-inch stub, above the bottom of the enclosure. Stub conduits to a uniform height (plus or minus 1/8 of an inch) and align within plus or minus 1/4 inch.
2. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends are not visible above the finished slab.
3. Unless otherwise noted on the Plans, spare conduits stubbing up through concrete floors and not adjacent to a wall shall be finished flush with floor with an RGS coupling. Provide an in-set metal plug (male thread) into coupling flush with floor.

4. Unless otherwise noted on the Plans, spare conduits stubbing up through concrete floors or grade, and adjacent to a wall or housekeeping pad shall extend 12 inches above slab/grade. The exterior edge of the conduit shall be a minimum of 1 inch from the wall/pad.
5. All stub-ups shall be provided with pull string.
6. Provide conduit labels on all stub-ups which are not flush mounted.

4.5 PROTECTION

Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensures coatings, and finishes are without damage or deterioration at the time of Substantial Completion.

- A. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
- B. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

4.6 CLEANING

On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

4.7 QUALITY CONTROL

A. TESTS

1. Conduits identified as meeting the requirements of 100 percent continuity shall be tested between source and destination as follows:
 - a. Testing shall be performed using a Digital Voltmeter or Biddle ohmmeter.
 - b. Testing values shall not exceed 5 ohms.
 - c. If testing values exceed 5 ohms, then corrective action shall be taken to reduce the resistance to 5 ohms or below.

- d. These measurements shall be documented, signed, and submitted to the Engineer for approval.

***** END OF SECTION *****

SECTION 16140

WIRING DEVICES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the various types of receptacles, connectors, switches, and finish plates.

1.2 RELATED WORKS SPECIFIED ELSEWHERE

<u>Section</u>	<u>Items</u>
16050	Basic Electrical Materials and Methods
16130	Raceways and Boxes

1.3 SUBMITTALS

See Section 01300.

1.4 QUALITY ASSURANCE

See Section 16050.

1.5 COORDINATION

A. WIRING DEVICES FOR OWNER FURNISHED EQUIPMENT

Match devices to plug connectors for Owner-furnished equipment.

B. CORD AND PLUG SETS

Match cord and plug sets to equipment requirements.

1.6 DEFINITIONS

Reference Section 16050, "Definitions."

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. AVAILABLE MANUFACTURERS

Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include the following:

1. Wiring Devices
 - a. Arrow Hart Div., Cooper Industries.
 - b. Bryant Electric, Inc.
 - c. Hubbell Inc.
 - d. Killark Electrical Mfg. Co.
 - e. Leviton Mfg. Co., Inc.
 - f. Pass & Seymour/Legrand.
2. Multi-Outlet Assemblies
 - a. Wiremold Co.

2.2 WIRING DEVICES

Comply with NEMA Standard WD 1, "General Purpose Wiring Devices." Terminals shall be rated for 75 degrees C (min.).

A. ENCLOSURES

NEMA 1 equivalent, except as otherwise indicated.

B. COLOR

Ivory except as otherwise indicated or required by Code.

C. RECEPTACLES, STRAIGHT-BLADE AND LOCKING TYPE

Except as otherwise indicated, comply with Federal Specification W-C-596 and heavy-duty grade of UL Standard 498, "Electrical

Attachment Plugs and Receptacles.” Provide NRTL labeling of devices to verify compliance.

1. General Purpose Convenience Outlets
 - a. Duplex receptacle configuration
 - b. Nylon face
 - c. Staked screw terminals for line, neutral, and ground connections.
 - d. Provisions for split bus
 - e. NEMA 5-20R
2. Special Purpose Receptacles
 - a. Staked screw terminals for line, neutral, and ground connections.
 - b. NEMA configuration as indicated.

D. RECEPTACLES, STRAIGHT-BLADE, SPECIAL FEATURES

Comply with the basic requirements specified above for straight-blade receptacles of the class and type indicated, and with the following additional requirements:

1. Ground-Fault Circuit Interrupter (GFCI) Receptacles – Class A (5 mA) Personal Protection

UL Standard 943, “Ground Fault Circuit Interrupters,” with integral NEMA 5-20R duplex receptacle arranged to protect only the connected receptacle and no other receptacles connected on the same circuit. Design units for installation in a 2-3/4-inch-deep outlet box without an adapter.

E. CONVENIENCE RECEPTACLES IN WET LOCATIONS

Convenience receptacles in wet locations shall comply with NEC Article 406.9 and shall be 20 A, 125 VAC rated terminated with binding screws.

F. SNAP SWITCHES

Quiet-type ac switches, NRTL listed and labeled as complying with UL Standard 20 “General Use Snap Switches,” and with Federal Specification W-S-896.

1. Lighting Switches

120/277 Vac only, rated 20 amperes.

2. Motor Rated Switches

Horsepower rated for application indicated.

G. WALL PLATES

Single and combination types that mate and match with corresponding wiring devices. Features include the following:

1. Color

Matches wiring device except as otherwise indicated.

2. Plate-Securing Screws

Metal with heads colored to match plate finish.

3. Material for Interior Finished Spaces

Lexan, except as otherwise indicated.

4. Material for Interior Unfinished Spaces: Galvanized steel.

5. Material for Exterior or Wet Locations: Cast Aluminum.

2.3 MULTI-OUTLET ASSEMBLIES

A. Comply with Standard UL 5, “Surface Metal Raceways and Fittings.”

B. COMPONENTS OF ASSEMBLIES

Products of a single manufacturer designed to be used together to provide a complete matching assembly of raceways and receptacles.

C. RACEWAY MATERIAL

Metal, with manufacturer's standard corrosion-resistant finish.

D. WIRE

No. 12 AWG.

PART 3 EXECUTION

3.1 INSTALLATION

A. IDENTIFICATION

Each receptacle, whether convenience, or dedicated, shall be labeled with the circuit from which its power is derived. Label as "CKT-XX" where XX = numerical circuit number.

1. Only one Panelboard servicing the site:

Label as "CKT-XX" where XX = numerical circuit number within the Panelboard.

2. More than one Panelboard servicing the site:

Label as "CKT XX-YY" where XX = Panelboard number and YY = numerical circuit number within the Panelboard.

Example:

A receptacle powered from circuit 03 of Panelboard [01 PB 02] would be labeled "CKT 02-03."

B. RECEPTACLE BOXES

1. Reference Section 16130 for box types.

2. Mounting Height

- a. Indoor, in WET Areas

Indoor receptacle boxes in WET areas shall be mounted 42 inches above the floor unless shown otherwise on the Plans.

b. Outdoor

Outdoor receptacle boxes shall be mounted 18 inches above grade unless shown otherwise on the Plans.

3. Reference Section 16130 for box cover types.

C. CONVENIENCE RECEPTACLES

Convenience receptacles shall be 20 A, duplex, white, GFCI, straight blade, 3-wire, grounding, unless called out otherwise on the Plans.

In addition to any GFCI requirements, all receptacles, convenience or dedicated, located in break rooms and kitchens shall be AFCI.

D. ARRANGEMENT OF DEVICES

Except as otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on bottom. Group adjacent switches under single, multigang wall plates.

1. See "Raceways and Boxes" Section for mounting height of devices.
2. Verify locations of outlets and switches in cabinetry with cabinet supplier and Owner prior to installation.

E. INSTALLATION PRACTICES

1. Install devices and assemblies plumb, level, flush and secure. Provide spacers on device screws to flush yokes or flanges to surface of wall within 1/16 of an inch where boxes are not flush with the wall surface. Install wiring devices such as receptacles to withstand 50 pounds force applied perpendicular to the device face with a maximum deflection of 1/16 of an inch.
2. Protect devices and assemblies during painting.
3. Use corrosion resistant devices in kitchen areas and outdoors.
4. Wiring connections shall be made by compression on the screw terminals. The wire shall be neatly and symmetrically wrapped around the screw a minimum of 180 degrees.

F. LIGHT SWITCH ORIENTATION

Install switches with the “off” position down. Install three- and four-way switches so the load is “off” when all switch handles are down.

G. TERMINATION PRACTICES

Connect phase, neutral, and grounding wires to devices with full loops around screws installed to tighten with tightening of the screw. Trim insulation to within 1/8 of an inch of screw terminal.

H. WALL PLATES

Install after painting is complete. Install with an alignment tolerance of 1/16 of an inch to plumb. Install at flush mounted devices so that all four edges are in continuous contact with finished wall surface without the use of mats or similar devices. Do not use plaster fillings.

3.2 GROUNDING

Connect receptacle or switch ground lug to device box for devices other than isolated ground type.

3.3 FIELD QUALITY CONTROL

Test wiring devices for proper connections, polarity, and ground continuity. Perform this testing with testing equipment designed for testing polarity and connections.

Operate each operable device at least six times.

Demonstrate charging the owner’s electronic devices at each USB receptacle.

Test ground-fault circuit interrupter operation with local fault simulations, using a tester designed for such testing, and according to manufacturer recommendations. Testing with integral test switches on the receptacle is not sufficient for this testing.

Replace damaged or defective components, and retest.

***** END OF SECTION *****

SECTION 16210

ELECTRICAL UTILITY SERVICES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section consists of electrical service and connection to the commercial power utility system (Power Company) and the work required in conjunction with the Power Company for their revenue metering. For this project the Power Company is Mason County PUD No. 1.

1.2 RELATED WORKS SPECIFIED ELSEWHERE

<u>Section</u>	<u>Items</u>
01500	Temporary Facilities
16050	Basic Electrical Materials and Methods
16060	Grounding and Bonding
16120	Conductors and Cables
16130	Raceway and Boxes

PART 2 PRODUCTS

2.1 MATERIALS

- A. Primary circuit to utility transformer, including vaults conduit, primary cable and utility transformer: provided by the Power Company.
- B. Current transformer and revenue metering: provided by the Power Company.
- C. Meter socket, current transformer enclosure, and connecting conduit: provided by the Contractor.

PART 3 EXECUTION

3.1 APPLICATION

Application for service to the Power Company has already been made by Owner.

Coordinate with the Power Company to ensure that their metering and service requirements are met during installation portion.

- A. The Contractor is responsible for any work necessary to place the service in operation as a complete installation. Provide any materials required and do any work necessary that is not provided or completed by the Power Company.
- B. Provide excavation and backfill for the Power Company's circuits and vaults. Locate the trench for such circuits as directed by the utility.
- C. Provide excavation, for vaults and conduits, to utility requirements.

3.2 INSTALLATION

- A. The Power Company will:
 - 1. Install the revenue meter.
 - 2. Install the primary conductors, conduits, and utility transformer.
- B. The Contractor is responsible to provide and/or install the following:
 - 1. Excavation for vaults/junction boxes and trench associated with the Primary circuit.
 - 2. Meter base and current transformer (CT) enclosure.
 - 3. Secondary conductors from the utility transformer to the service disconnect.

***** END OF SECTION *****

SECTION 16230

GENERATOR ASSEMBLIES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section consists of a packaged diesel engine generator set [01 GEN 01] with accessories as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
16050	Basic Electrical Materials and Methods
16060	Grounding and Bonding
16410	Enclosed Switches and Circuit Breakers

1.3 DEFINITIONS

A. FULL LOAD

The generator delivering 100 percent of its rated output power.

B. MAXIMUM FREQUENCY DIP AND PEAK

The maximum allowable frequency deviation, in percent, below and above the generator's specified output frequency during application-specific starting and stopping steps as specified in 1.5.

Example: A 10 percent MAXIMUM FREQUENCY DIP AND PEAK on a 480 Vac, 3 PH, 60 Hz generator equates to ± 10 percent (± 6 Hz) maximum deviation from 60 Hz, or 54 Hz absolute minimum to 66 Hz absolute maximum frequency limits during the worse-case specified step changes while either loading or unloading.

C. MAXIMUM FREQUENCY RECOVERY TIME PERIOD

The maximum period of time, in seconds, for the frequency to recover back to its specified steady-state operating band following load transitions from no load to full load or from full load no load.

Example: A 5 second MAXIMUM VOLTAGE RECOVERY TIME PERIOD requires that the generator repeatedly recover from full load added or removed load steps within 5 seconds maximum. This means that during a full load transition, in either direction, the generator frequency may deviate from its specified steady-state operating band for a maximum of 5 seconds before it has fully recovered back to its specified steady-state operating band.

D. MAXIMUM STEADY-STATE FREQUENCY OPERATING BAND

The maximum allowable frequency deviation, in percent, below and above the generator's specified operating frequency during steady-state operating conditions at any load between no load and full load.

Example: 0.5 percent MAXIMUM STEADY-STATE FREQUENCY OPERATING BAND on a 480 Vac, 3 PH, 60 Hz generator equates to ± 0.5 percent (± 0.3 Hz) maximum deviation from 60 Hz, or 59.7 Hz absolute minimum to 60.3 Hz absolute maximum frequency limits at any stable operating load from no load to full load.

E. MAXIMUM VOLTAGE DIP AND PEAK

The maximum allowable voltage deviation, in percent, below and above the generator's specified output voltage during application-specific starting and stopping steps as specified in 1.5.

Example: 25 percent MAXIMUM VOLTAGE DIP AND PEAK on a 480 Vac, 3 PH, 60 Hz generator equates to ± 25 percent (± 120 Vac) maximum deviation from 480 Vac, or 360 Vac absolute minimum to 600 Vac absolute maximum voltage limits during the worse-case specified step changes while either loading or unloading.

F. MAXIMUM VOLTAGE RECOVERY TIME PERIOD

The maximum period of time, in seconds, for the voltage to recover back to its specified steady-state operating band following load transitions from no load to full load or from full load no load.

Example: A 5 second MAXIMUM VOLTAGE RECOVERY TIME PERIOD requires that the generator repeatedly recover from full load added or removed load steps within 5 seconds maximum. This means that during a full load transition, in

either direction, the generator voltage may deviate from its specified steady-state operating band for a maximum of 5 seconds before it has fully recovered back to its specified steady-state operating band.

G. MAXIMUM STEADY-STATE VOLTAGE OPERATING BAND

The maximum allowable voltage deviation, in percent, below and above the generator's specified operating voltage during steady-state operating conditions at any load between no load and full load.

Example: 2 percent MAXIMUM STEADY-STATE VOLTAGE OPERATING BAND on a 480 Vac, 3 PH, 60 Hz generator equates to ± 2 percent (± 9.6 Vac) maximum deviation from 480 Vac, or 470.4 Vac absolute minimum to 489.6 Vac absolute maximum voltage limits at any stable operating load from no load and full load.

H. NO LOAD

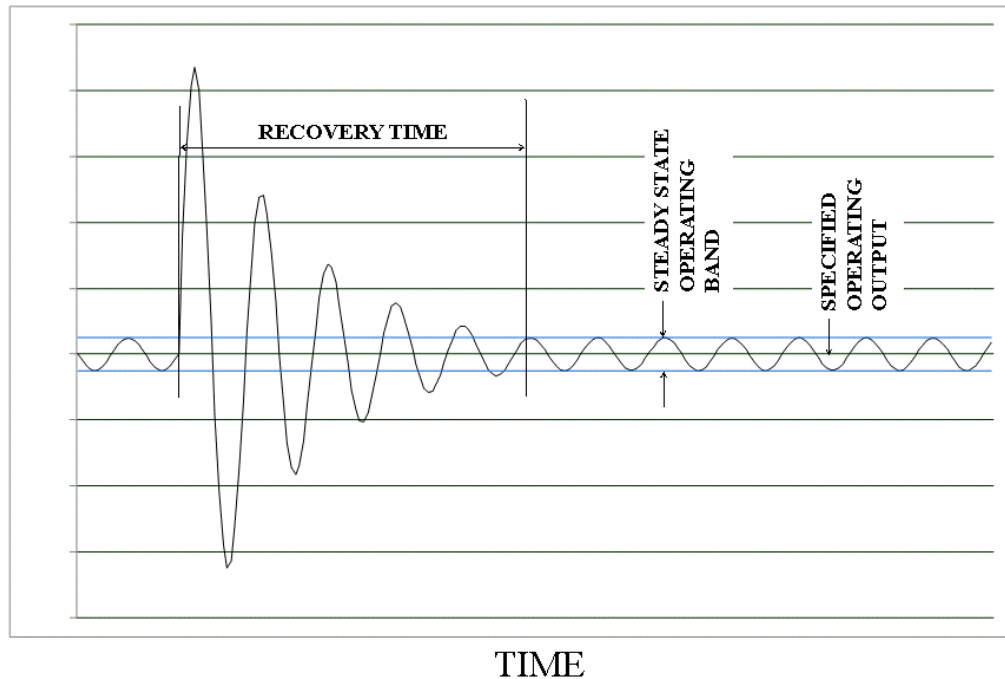
The generator delivering 0 percent of its rated output power.

I. STANDBY POWER OUTPUT RATING

The power output rating equal to the power the generator set delivers continuously under normally varying load factors for the duration of an electrical utility power outage. The power output rating is the gross electrical power output of the generator set minus the total power requirements of the electric motor driven cooling fan, water pump, and other auxiliary loads related to the generator set operations.

J. DEFINITIONS REFERENCE GRAPH

The following graph is a reference chart to better define the following terms "MAXIMUM VOLTAGE RECOVERY TIME PERIOD," "MAXIMUM STEADY-STATE VOLTAGE OPERATING BAND", "MAXIMUM FREQUENCY RECOVERY TIME PERIOD," and "MAXIMUM STEADY-STATE FREQUENCY OPERATING BAND." The Y axis can either be voltage or frequency and the X axis is time.



1.4 REFERENCES

- A. The latest Washington State adopted, published edition of a reference shall be applicable.
- B. All Washington State amendments adopted prior to the effective date of this Contract shall be applicable.
- C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
 1. National Fire Protection Association (NFPA)
 - a. NFPA 30 Flammable and Combustible Liquids Code
 - b. NFPA 37 Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines
 - c. NFPA 70 National Electrical Code
 2. International Fire Code (IFC)
 3. International Building Code (IBC)

4. National Electrical Manufacturers Association (NEMA)
 - a. NEMA MG 1: Motors and Generators
5. International Mechanical Code (IMC)
6. Underwriters Laboratory (UL)
 - a. UL 2200 Generator Engine Generator Assemblies
 - b. UL 142 Steel Aboveground tanks for Flammable and combustible Liquids.

1.5 PERFORMANCE REQUIREMENTS

- A. Engineering calculations indicate a standby power output rating requirement of 25 kW at 80 percent power factor at **240/120** volts, 1 phase, 60 hertz while operating under the site conditions listed in Part 1.8 of this Section in an ambient temperature range of 0 to 104 degrees F at less than 90 percent rated capacity. The manufacturer shall calculate generator unit size according to the following bus rated loads and starting steps:

Step No./ Device No.	Device Description	Motor Code	Load Hp	Load kVA	Starter Type	No. of Pulses VFD only)
Step 1						
Lighting	Pump House Interior and Exterior Lighting	-	-	0.06	-	-
Receptacles	Pump House General Use Receptacles			1.44		
01 GADP 01	Generator Ancillary Power			2.08		
01 SMPS 01	Skid-Mounted Booster Pump Station ancillary power	-	-	1.50	-	-
01 HT 01	Unit heater	-	-	3.00	-	-
01 EF 01	Exhaust Fan			1.50		
01 MTR 01	Motor, Booster Pump 1	NA	5.0	6.72	VFD	6
01 MTR 02	Motor, Booster Pump 2	NA	5.0	6.72	VFD	6

- B. The Generator shall be suitable for operation with pulse width modulated variable frequency drives (connected as loads as shown on the Plans and operating motors throughout a speed range of 6 to 60 hertz) without detrimental effects on voltage or frequency regulation and stability.

C. MAXIMUM VOLTAGE DIP AND PEAK

Shall not exceed 25 percent.

D. MAXIMUM FREQUENCY DIP AND PEAK

Shall not exceed 10 percent.

E. MAXIMUM STEADY-STATE VOLTAGE OPERATING BAND

Shall not exceed 2 percent.

F. MAXIMUM STEADY-STATE FREQUENCY OPERATING BAND

Shall not exceed 0.5 percent.

G. MAXIMUM VOLTAGE RECOVERY TIME PERIOD

Shall not exceed 5 seconds.

H. MAXIMUM FREQUENCY RECOVERY TIME PERIOD

Shall not exceed 5 seconds.

I. ALTERNATOR OUTPUT WAVEFORM

At no load, harmonic content measured line-to-line or line-to-neutral does not exceed 5 percent total and 3 percent for single harmonics. The telephone influence factor, determined according to NEMA MG 1, does not exceed 50.

J. SUSTAINED SHORT-CIRCUIT CURRENT

For a 3-phase, bolted short circuit at the system output terminals, the system will supply 300 percent of rated full load current for not less than 10 seconds to coordinate circuit breaker tripping. This system shall include over-voltage relay protection to preclude damage to any generator system component.

K. TEMPERATURE RISE OF GENERATOR

Within limits permitted by NEMA MG 1, when operating continuously at full nameplate rating, the temperature rise of the generator shall not exceed 250 degrees F over 100 degrees F ambient.

L. STARTING TIME

The maximum allowable time period to cold start the generator, while operating at the low end of the specified temperature range, and have its voltage and frequency sufficiently stable for a transfer switch to accept or automatically initiate a power transfer, shall be 10 seconds.

1.6 SUBMITTALS

For each generator set submit under provisions of Section 01300 and as specified herein.

A. PRODUCT DATA

Provide the manufacturer and a full description of the generator set and associated components. Include features, ratings, and performance including, but not limited to:

1. Engine including the following:
 - a. Horsepower at rated speed and load
 - b. Emission Ratings
 - c. Lubrication oil capacity
2. Overall dimensions of generator set system including the sub-base fuel tank, and the enclosure.
3. Fuel consumption for 1/4, 1/2, 3/4, and full load of generator set
4. Electrical governor
5. Coolant heater
6. Alternator
 - a. Electrical rating (kVA, reactance, time constants, temperature rise, etc.).
7. Voltage regulator type, make, model, and wiring diagram
8. Noise levels at twenty-three feet (7 meters) in a free field

9. Exhaust pipe and muffler sizing backpressure calculations
10. Warranty and Service Agreement documentation
11. Vibration isolation calculations, Plans and seismic certification from manufacturer per the seismic information listed in Part 1.8B of this Section.
12. Bill of Materials
13. Wiring Diagrams

B. QUALITY ASSURANCE

Provide documentation showing all CD&Es (compliances, deviations, and exceptions) for this Specification.

C. GENERATOR SIZING CALCULATIONS

Submit calculations showing that the submitted generator's standby power output rating is capable of meeting the specified loads in the specified steps listed. The calculations shall show that the generator meets the specified performance requirements.

D. OPERATION AND MAINTENANCE MANUAL

1. Field Test Reports

Indicate and interpret test results for compliance with manufacturer's published standards for unit provided. Provide written approval of installation in accordance with all manufacturers' recommendations.

2. Operation and Maintenance Data

Provide information to be included in the operation and maintenance equipment manuals specified in Section 01300, Section 11000, and as specified herein.

3. Test Reports

The O&M manual shall include a copy of the factory test data and the field test report.

4. Service Agreement and Warranty

Include copies of the Service Agreement and Warranty in the Operation and Maintenance Manual.

1.7 QUALITY ASSURANCE

See Section 16050.

A. SOURCE LIMITATIONS

1. Obtain engine generator set from a single generator distributor with responsibility for the complete system. Furnish a new product built from components with proven reliability and compatibility. The generator set shall be coordinated to operate as a unit as evidenced by records of prototype testing by the OEM.
2. The warranty shall be supported by the original distributor, not offset to an engine manufacturer, an alternator manufacturer, or a new manufacturer's distributor.
3. The local representative for the generator manufacturer shall have the minimum qualifications and meet the minimum requirements:
 - a. Shall have represented the product for a minimum of 5 years.
 - b. Shall provide, on request, a reference list of five similar projects, no older than 2 years, with site contact information.
 - c. Shall provide formal classroom or online training for service and maintenance of generators and transfer switches on a regular basis. The schedule and pricing for this training shall be available on request. The training shall be conducted in a location that is within a 1 day drive of the job site.
 - d. Shall have a field service group, with no fewer than 10 qualified field service technicians, dedicated to generator repair and maintenance with dedicated service vehicles, parts, and tooling needed for general maintenance and common repairs.

- e. Shall have qualified field service technicians with a minimum of 2 years of generator field experience on the product being supplied and shall be factory trained and certified.
 - f. Shall have qualified field service technicians with a current EL-07 Maintenance Electrician License as required by the Washington State Department of Labor and Industries.
 - g. Shall have a warehouse of with sufficient parts located within 150 miles of the job site.
- 4. Only a factory direct or a first-tier distributor shall be acceptable. Second-tier distributors are not approved.
 - 5. Only approved local distributors shall supply equipment provided under this contract. Equipment by non-local distributors shall not be accepted.
 - 6. The distributor shall be the authorized engine distributor for the prime mover.

B. PRODUCT SELECTION

The structural, mechanical and electrical designs shown on the Plans are based on the equipment manufactured by Cummins NW. Any modifications to the mechanical, structural, electrical, instrumentation and control, and other portions of the work that may be required to adapt the layout, connections, and details shown on the Plans to the equipment actually furnished shall be at no additional cost to the Owner. All necessary design revisions shall be made at the Contractor's sole expense. All redesign information prepared by the Contractor shall be submitted for review prior to incorporating the redesign into the work.

- C. Generator set to be UL 2200 listed "Stationary Engine Generator Assemblies."

D. EMISSIONS

EPA certified for all current EPA emissions requirements.

E. FACTORY TEST

Test assembled generator set at the factory prior to shipment to the job site. The power factor for the factory test shall be at 0.8 p.f.

1. Show the following conditions at load and no load on the Generator Set: Charging System Volts, Voltage Output, Frequency, Coolant Temperature, and Oil Pressure, and other pertinent information on the test report. Provide a plot of the transient voltage and a plot of the frequency response versus time as a result of a full load single step.
2. Perform manufacturer's standard factory tests.
3. Test for a minimum of 30 minutes at full load per NFPA 110.

1.8 PROJECT/SITE CONDITIONS

A. ENVIRONMENTAL REQUIREMENTS

Engine generator system is designed, engineered, and rated to withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: Minus 5 degrees F to 122 degrees F.
2. Relative Humidity: 0 to 95 percent.
3. Elevation: Sea level to **500 feet..**

B. SEISMIC REQUIREMENTS

The entire generator package including all mounted accessories shall comply with the requirements of the 2015 IBC and ASCE 7-05 Minimum Design Loads for Building and Other Structures, Chapter 13 "Seismic Design for Nonstructural Components," as referenced and amended by the IBC. Seismic design parameters are as follows:

1. Risk Category **IV**, Seismic Design Category **D**.
2. Component Importance Factor: $I_p = 1.5$.
3. Design response acceleration parameters:
 - a. $S_{DS} = \mathbf{1.247g}$.
 - b. $S_{D1} = \mathbf{0.666g}$.

1.9 WARRANTY AND MAINTENANCE

A. WARRANTY

1. The manufacturer shall warrant the materials and workmanship of the generator set for a minimum of 5 years, or 2,500 hours from the registered commissioning and startup.
2. The warranty shall be comprehensive and shall include all components included in the generator package. No deductibles shall be allowed for travel time, service hours, repair part costs, etc., during the warranty period.

B. 2-YEAR MAINTENANCE SERVICE

Beginning at time of Substantial Completion, provide 24 months full maintenance service performed by qualified service technicians of the manufacturer's designated service organization. Include twice yearly inspections to check for defects and operational abnormalities. Include routine preventive maintenance (oil changes, filter changes, belt adjustments, etc.) as recommended by the manufacturer and perform adjustments as required to bring the generator performance back into compliance with the original specifications. Provide OEM parts and supplies to complete all service to support all factory warranty requirements with written reports to the Owner upon completion of visits. No deductibles shall be allowed for travel time, service hours, repair part costs, etc., during the warranty period.

Provide a 2-hour load bank test on the generator at 11 months and 23 months from the time of Substantial Completion.

1.10 EXTRA MATERIALS

Reference Specification Section 16050 for spare parts.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. APPROVED MANUFACTURERS

1. Kohler as provided by Power Systems West.
2. Cummins Power Generation as provided by Cummins Northwest.

3. MTU as provided by Pacific Power Group.
4. Caterpillar as provided by NC Power Systems.

2.2 ENGINE

A. FEATURES

1. Four-stroke cycle diesel engine of either vertical in-line or V-type suitable for operation on No. 2 diesel fuel.
2. Engine speed shall be governed by an electronic governor. Refer to frequency requirements specified earlier in this Specification.

B. COMPONENTS

1. Oil Pump

Gear type lubricating oil pump for supplying oil under pressure to main bearings, crankpin bearings, pistons, piston pins, timing gears, camshaft bearings, and valve rocker mechanism.

2. Oil Filters

Full flow oil filters conveniently located for servicing, with a spring-loaded bypass valve to ensure oil circulation.

3. Air Filter

Dry type air filter.

4. Cooling System

Sufficient to cool the engine when the generator set is delivering full rated load in an ambient temperature of 104 degrees F.

a. Engine-driven, centrifugal-type water circulating pump.

b. Thermostatic valve.

5. Coolant/ Jacket/ Block Heater

As described in Part 2.6-B of this Section.

6. Electrical starters sufficient to start the engine within 10 seconds of call to start.
7. Batteries

Lead acid batteries shall be of sufficient capacity to permit starting the generator engine a minimum of four times without recharging. Batteries are to be mounted in an earthquake- and drip-proof rack on the skid, frame, or other approved separate location with required connections provided.
8. Battery Heater

As described in Part 2.6-B of this Section.
9. Battery Charger
 - a. Silicone rectifier static type, self-regulated with high current and full float operation with a filtered output.
 - b. The charger shall be capable of providing a 10 A DC high current charging rate when the battery voltage is below the “float voltage set point.” Full floating charging when voltage is above the set point.
 - c. Battery charger operates from 120 volts, single phase AC connected to Generator Auxiliary Device Panel (GADP) as per Section 2.6.A.
 - d. The charger shall be complete with voltmeter, ammeter, charging rheostat, automatic equalizing timer, and high/low battery voltage alarm.
 - e. The battery charger shall be factory mounted with vibration isolators to prolong service life.
 - f. Battery charger shall include standard NFPA outputs where generator is legally required for life safety.
10. Provide watertight flex connections for all conduits and piping attached to generator.

2.3 ALTERNATOR

- A. Four pole, 1,800 rpm revolving field generator.

- B. Enclosure shall be of drip-proof construction.
- C. Insulation Class H.
- D. Wiring shall be 12-lead, reconnectable, and configured for the specified voltage, phasing, neutral point, and frequency.
- E. ALTERNATOR HEATER

As described in Part 2.6-B of this Section.

2.4 VOLTAGE REGULATOR

An electronic voltage regulator shall be provided.

2.5 CONTROL PANEL

The Control panel shall be of the rotatable dead-front type, vibration free mounted on the generator set. The generator control panel and the generator main circuit breaker shall be installed per NEC clearances and provide accessibility to equipment. The tops of control panels and the circuit breakers shall be mounted a maximum of 72 inches above the finished floor.

- A. The control panel shall operate at 12 or 24 VDC from the generator/battery electrical system as required by manufacturer based on the size of the system.
- B. Control panel shall include the following functions/devices:
 - 1. Automatic Starting System
 - a. Provides three 15 second cranking cycles and two rest periods followed by a lockout and alarm.
 - b. Operation is initiated by the closing of a remote Form A contact in the automatic transfer switch control circuit.
 - 2. Indicating light for alarm condition.
 - 3. Indication for the following:
 - a. Running
 - b. Low coolant level

- c. High coolant temperature
 - d. Low oil pressure
 - e. Over speed
 - f. Over crank
 - g. AC volts for each phase
 - h. AC current for each phase
 - i. Frequency
 - j. Lube oil pressure
 - k. Coolant temperature
 - l. Run Time
 - m. Number of Starts
4. Engine "AUTO-OFF-MANUAL" control selector switch.
 5. Red colored emergency shutdown pushbutton/switch.
 6. Time delay relay to permit operation at "NO-LOAD" after retransfer of load to normal source (cool down timer).
 7. Automatic safety controls which shut down the engine on:
 - a. Low lubricating oil pressure
 - b. Low coolant level
 - c. High jacket water temperature
 - d. Engine over speed
 8. Include a Form A (N.O. Dry) contact for remote connection for each of the following Generator functions.
 - a. Running

- b. General Alarm
 - c. Fail (shall include, as a minimum, any combination of conditions in 8 above)
 - d. AUTO-OFF-MANUAL control switch in Auto Mode
 - e. Low Battery Voltage
 - f. Low Oil Pressure
 - g. High Coolant Temperature
 - h. Low Fuel Level
 - i. High Fuel Level
 - j. Fuel Tank Leak
9. Control Cabinet Heater

As described in Part 2.6-B of this Section.

2.6 ACCESSORIES

A. GENERATOR AUXILIARY DEVICE PANEL

The generator manufacturer shall provide, install, and prewire a Generator Auxiliary Device Panel (GADP) as part of the generator system with the following minimum features:

- 1. The GADP shall consist of a NEMA 1 gasketed 240/120 VAC rated single phase load center with a main breaker and appropriately sized branch circuit breakers for the battery charger and the heaters listed below under GENERATOR HEATERS. Available power to the panel shall be 208/120 VAC, single phase.

Exception:

The GADP load center can be replaced with one or more 20 A, 4-plex receptacle sets in cast aluminum boxes under the following conditions:

- a. *The battery charger and all heater loads are 120 VAC, single phase,*

- b. *The sum of the battery charger and all heater loads does not exceed 1920 VA (16 A),*
 - c. *All loads are prewired by the manufacturer with grounded plug cables,*
 - d. *The receptacles are placed within reach of all load plugs,*
 - e. *If required, multiple 4-plex receptacle sets are connected together by the manufacturer (provide a single electrical connection point for the Contractor).*
2. For outdoor generators, the GADP shall be securely mounted within the enclosure in a location easily accessible by the operator and to a Contractor-provided power conduit.
 3. The GADP shall be internally connected to the described loads by the generator manufacturer.
 4. It is the intent that the Contractor need only provide a single power conduit and associated conductors to the manufacturer-provided GADP and terminate the conductors to a main circuit breaker, neutral, and ground. All connections for heater controls and devices shall be prewired and pretested by the manufacturer.

B. GENERATOR HEATERS

1. Coolant Heater

Engine mounted, thermostatically controlled immersion type engine coolant heater to ensure a minimum coolant temperature of 120 degrees F at ambient room temperature of 5 degrees F. Provide as shown in the table below.

2. Fuel Heater

Thermostatically controlled engine fuel heater. Provide if shown in the table below.

Provide the following generator set heaters:

Device	Voltage Configuration	Wattage (W)
Coolant Heater	120 Vac	1,000
Battery Heater	120 Vac	125
Oil Pan Heater	120 Vac	150
Alternator Heater	120 Vac	100

C. CIRCUIT BREAKERS

1. Provide an output main circuit breaker according to the plans and specifications section 16410. This breaker shall be lockable in its open position. The breaker shall have an auxiliary contact that is open when the breaker is in the open position. This circuit shall be prewired by the generator manufacturer to dedicated terminals in the generator control panel. Wire between these devices in LFMC conduit.
2. Provide a generator field protection circuit breaker, or other means to protect the alternator.
3. Provide a load bank circuit breaker according to the plans and that meets specification section 16410.

D. DECALS, PLACARDS, AND SIGNS

1. The generator manufacturer shall provide all decals and signage as required by the regulatory and/or inspecting agency for the particular installation, including, but not limited to the following:
 - a. One hazardous material placard, diamond shape, 4 color (red, white, blue, yellow) with numbers 020 (diesel, kerosene, fuel oil) in accordance with NFPA 704.
 - b. A permanent sign at the fill point for the fuel tank. The sign shall include the filling procedure and tank calibration chart. The filling procedure shall require the person filling the tank to determine the gallons required to fill it to 90 percent of capacity before commencing the fill operation.

2. The Contractor shall provide the following in an easily viewable location on the fuel tank unless noted otherwise:

- a. One 3" x 12" decal labeled "Diesel" (black/white).

E. VIBRATION ISOLATORS

1. Provide vibration isolators between the unit and the sub-base fuel tank. The isolation mountings shall consist of malleable cast iron top and bottom housings incorporating steel spring or elastomeric construction and shall be provided with built-in leveling bolts, elastomeric pad and built-in resilient chocks to control oscillation and withstand lateral forces in all directions. Isolators shall be presized and installed in accordance with the recommendations of the generator set manufacturer.
2. Vibration isolation efficiency shall be 96 percent at 1,800 rpm. Provide Korfund or equal.
3. Calculations shall be provided with the vibration isolation submittal demonstrating that the specified efficiency can be met with the project specific system characteristics.
4. Vibration isolators may be waved with manufacturer's documentation that the entire generator package including mounted accessories is IBC certified without them.

F. SPRING ISOLATORS

Provide spring isolators for all generators 500 kW and larger.

G. ANCHORS

Anchors used to secure the generator to the base or other stable surface shall be designed and sized by the manufacturer. Anchors shall be cast-in-place 316 stainless steel anchor bolts or drilled-in 316 stainless steel anchors set with epoxy adhesive. Expansion type anchors shall not be acceptable. The Contractor shall provide and install these anchors.

2.7 SUBBASE TANK

- A. Provide dual wall UL 142 listed sub base tank sized to meet 24 hours runtime at full load or 78 gallons whichever has a larger volume. The external tank profile shall be "flat" within ± 0.25 inches of vertical offset per 100 inches of horizontal length (± 0.14 degrees maximum).

- B. The sub base tank shall have custom dimensions to reduce the height and accommodate the filling and venting components.

C. LEVEL SWITCH

Provide a liquid level float switches, Pneumercator LS600 or equal, assembly capable of the following:

1. High level alarm set at 90 percent tank capacity
2. Low level alarm set at 30 percent tank capacity

D. LEAK DETECTION SWITCH

Provide secondary containment leak detection. Provide Pneumercator LS600LD or equal.

E. DROP TUBE

Provide aluminum drop tube at the fuel fill, fuel return, and fuel supply ports. The drop tube with diffuser or suction strainer shall terminate a minimum of 6 inches from the bottom of the tank and shall be installed in a manner, which avoids excessive vibration.

F. FUEL FILL CONNECTION

Provide a 2-inch quick connect adapter and cap. Materials of construction shall be A36 carbon steel or aluminum meeting ASTM B221.

G. SPILL CONTAINER

Provide a 5-gallon spill container with a hinged, lockable cover and a manual drain valve into the primary tank. The spill container shall be of steel construction with a powder coated finish. The spill container shall be Morrison Bros. Fig. 516 or equal.

H. NORMAL VENT

Provide a 2-inch-diameter upward vent for normal atmospheric venting. The normal vent shall terminate outside, 12 feet above adjacent ground level. Vent piping shall be Schedule 40 Type S, Grade A steel pipe conforming to ASTM A53. The contractor shall provide all supports for the vent.

I. PRESSURE VACUUM VENT

A pressure/vacuum vent shall be installed at the top of the normal vent pipe, set at 1 oz per square inch. The body construction shall be Aluminum with stainless steel seat and poppet and the vacuum gasket shall be constructed of fuel resistant material. The pressure/vacuum vent shall be in accordance with NFPA 30. Provide Morrison Bros. Fig. 748 or equal.

J. EMERGENCY VENTS

Supply emergency vents for pressure relief only, Manufacturer shall size to prevent a pressure greater than 2.5 psi for the secondary containment tank and primary tank. The emergency vents shall terminate outside. Construction shall be aluminum with painted cast iron cover and Viton O-ring seat material; galvanized materials shall not be used. Mounting connection shall be male NPT. Vents shall be UL listed and in accordance with NFPA 30. Provide Morrison Bros. Fig. 244 or equal.

2.8 EXHAUST SYSTEM

A. Sufficiently sized to ensure against loss of power due to excessive backpressure in accordance with engine manufacturer's recommendations. Include a drain plug and drip leg in low point of exhaust piping to protect engine. Terminate exhaust piping with a rain cap.

B. The exhaust systems shall be mounted inside the enclosure.

C. FLEX CONNECTION

Provide a stainless-steel flexible exhaust connector, with an exhaust temperature test fitting, flanged for service disconnection.

D. SILENCER

Provide a critical grade silencer. Silencer construction shall be steel with high temperature paint or aluminized finish.

2.9 ENCLOSURE

A. ACOUSTICAL ENCLOSURE

The Generator shall be provided with a skintight acoustical weather protective enclosure.

1. The enclosure shall reduce the sound pressure level of the generator set while operating at full rated load to an average of **68** dBA at any location 23 feet (7 meters) from the generator set in a free field environment.
2. The enclosure shall be constructed of minimum 12-gauge steel for framework and 14-gauge steel for panels. The enclosure shall have hinged access doors to maintain easy access for all operating and service functions. All hardware and hinges shall be stainless steel. All doors shall be lockable and include retainers to hold the door open during servicing. The roof shall be cambered to prevent the accumulation of water. The roof and walls shall be designed to withstand snow and wind loads per the IBC.
3. All sheet metal shall be primed for corrosion protection and finish painted with a color chosen by the Owner from the manufacturer's standard options.
4. The air intake and exhausts shall be sized to provide ample airflow for the generator set operation at rated load in ambient temperature of 100 degrees F.

2.10 FINISH

The entire standby generator set assembly with accessories is to be factory painted, color chosen by Owner from manufacturer's standard colors. Generator set manufacturer shall provide appropriate epoxy/polyurethane coating system for high heat conditions.

PART 3 EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

Deliver engine generator set and system components to their final locations in protective wrappings, containers, and other protection that will exclude dirt and moisture and prevent damage from construction operations. Remove protection only after equipment is safe from such hazards. Field repair of material or equipment made defective by improper storage or site construction damage by other trades may be cause for rejection of installation.

3.2 INSTALLATION

- A. Install the complete generator set and accessories per the manufacturer's installation instructions.
 - 1. Anchor the generator set to concrete housekeeping base or pad with high strength anchors and adequate penetration suitable for the Seismic Design Category as specified in the Plans.
 - 2. Make all electrical connections between accessory items, which are not factory wired, prior to requesting the test engineer.
- B. Maintain minimum workspace around unit and components per manufacturer's installation shop plans and NFPA 70 (NEC).
- C. Provide a complete fill of lubricating oil.
- D. Provide a complete fill of fuel in diesel storage tank before testing.
- E. Provide a complete fill of manufacturer approved antifreeze (ethylene-glycol) and water to protect the engine and heat exchanger cooling system to minus 25 degrees F.
- F. Contractor shall locate generator control panel and the generator main circuit breaker per NEC clearances and provide accessibility to equipment. Neither shall be mounted more than 72 inches above the floor. Include all costs associated with relocating the standard control/service panel arrangement on generator set to maintain code requirements in the Bid Cost.
- G. The generator set shall not be started up or tested in the field until all exhaust piping has been insulated as specified and shown on the Plans. All intake and exhaust louvers and fuel system components shall be fully functional.

3.3 IDENTIFICATION

Identify field installed wiring, components, and provide warning signs as specified in Section 16050.

3.4 GROUNDING

Provide ground continuity to facility electrical ground system as indicated in the Plans and Specification 16060.

3.5 FIELD QUALITY CONTROL

- A. Provide services of a factory authorized service representative to provide inspection results of field visit and field testing in writing.

- B. TESTING AGENCY

Provide the services of a qualified independent testing agency to perform specified field quality-control testing.

- C. TESTING

- 1. Prior to Energization

After installing disconnect switches and circuit breakers, perform visual and mechanical inspection of enclosure and devices.

- 2. Provide third party breakers testing per Specification 16050, Section 3.

Check connections and mounting for proper torque.

Correct or replace malfunctioning units and retest.

Remove any burrs, filings, or other foreign materials from enclosure. Completely wipe down and vacuum enclosure.

- 3. After Energization

After electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

Correct malfunctioning units on site where possible and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

- D. FIELD TEST

Test the assembled generator set after installation at the job site is complete.

- 1. Advise the Engineer, the Integrator, the Contractor, the local Fire Prevention Inspector, and the Owner of the proposed time and date of the field test at least 2 weeks in advance so that the test may be witnessed if desired.

2. Under supervision of a factory authorized service representative, pretest all system functions, operations, and protective features. Provide all instruments and equipment required for tests. Adjust to ensure operation is according to specifications.
3. Fuel, lubricating oil, and antifreeze shall be checked for conformity to the manufacturer's recommendations and these specifications under the environmental conditions present and expected.
4. Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. These shall include, but not be limited to: all electric heaters, battery charger(s), etc.
5. Cold Start Test
 - a. The unit shall demonstrate the ability to start from a "cold" standby condition (i.e., normal standby mode with engine coolant temperature established by properly functioning water-jacket heater).
6. Calibration and PLC Signal Status Check
 - a. Calibrate all sensors and instruments.
 - b. Verify the scaling and connections of each signal to the PLC. Coordinate this work with the Integrator.
7. Generator Load Testing
8. Generator load testing shall be provided using a manufacturer-provided temporary load bank at 1.0 power factor. The generator shall be operated at 50 percent of full load rating for thirty minutes, followed seamlessly by thirty minutes at 80 percent of full load rating, followed seamlessly by one hour at 100 percent full load rating.
9. After the first 15 minutes at full load, the following shall be recorded at 15-minute intervals (four recordings).
 - a. Voltage (phase to phase and phase to ground) and phase rotation
 - b. Amperage (each phase)

- c. Frequency
- d. Fuel pressure, oil pressure, and water temperature
- e. Exhaust gas temperature at engine exhaust outlet
- f. Ambient temperature

During the load test period, check for exhaust leaks, path of exhaust gases outside the building or enclosure, cooling air flow, movement during starting and stopping, vibration during 80 percent and 100 percent loading.

A certified copy of the test results shall be given to the Engineer and supplied with the O&M manuals.

- 10. Subbase Fuel Tank Test
- 11. The following test shall be observed by the local Fire Prevention Inspector:
 - a. Prior to any filling of combustible or flammable liquids the base tank shall be pressure tested per NFPA 30, Section 2.4.2. Include the test report in the O&M manuals.
 - b. The fuel fill container shall be tested for proper operation.
- 12. The Contractor shall demonstrate the backup power system is fully functional by simulating power outages. Coordinate phase rotation with the Contractor prior to transferring power.
- 13. Refill the generator tank after completion of field testing.

E. RETEST

Correct deficiencies identified by field tests and observations, and retest until specified requirements are fully met.

3.6 TRAINING

- A. The manufacturer of the generator set shall conduct specifically organized training sessions covering operation and maintenance of the unit for personnel employed by the Owner. The training sessions shall be conducted to educate and train the personnel in maintenance and operation

of all components of the unit. Training shall include, but not be limited to, the following:

1. Preventative maintenance procedures
 2. Trouble-shooting
 3. Calibration
 4. Testing
 5. Replacement of components
 6. Automatic mode operation
 7. Manual mode operation
 8. Fuel and monitoring system
 9. Spare parts that have been provided
- B. At least one training session, at least 3 hours in duration, shall be conducted at the site after startup of the system. The manufacturer shall prepare and assemble specific instruction materials for each training session and shall supply such materials to the Owner at least 2 weeks prior to the time of the training.

3.7 FINAL ADJUSTMENTS

- A. Adjust voltage and frequency output of generator set to nominal ratings and mark gauges with plastic pen for normal, operation references for Owner.
- B. Adjust time response of control system to meet site performance requirements.
- C. Check all remote connections again for proper tightness.

3.8 CLEANING

Upon completion of installation and startup, inspect engine generator set. Remove paint splatters, other spots, dirt, and debris. Perform touchup painting to cover scratches and marks to finish. Match original finish of generator set.

***** END OF SECTION *****

SECTION 16410

ENCLOSED SWITCHES, FUSES AND CIRCUIT BREAKERS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section consists of individually mounted switches and circuit breakers used for the following:

- A. Feeder and equipment disconnect switches
- B. Feeder and branch-circuit protection
- C. Motor safety disconnect switches

1.2 RELATED WORKS SPECIFIED ELSEWHERE

<u>Sections</u>	<u>Item</u>
01300	Submittals
16050	Basic Electrical Materials and Methods
16140	Wiring Devices

1.3 SUBMITTALS

Submit under the provisions of Section 01300.

Manufacturer's Product Data for disconnect switches, circuit breakers, and accessories specified in this Section.

Maintenance data for tripping devices to include in the operation and maintenance manual specified in Section 16050.

1.4 QUALITY ASSURANCE

See Section 16050.

Obtain disconnect switches and circuit breakers from one source and by a single manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. AVAILABLE MANUFACTURERS

Subject to compliance with requirements, manufacturers offering disconnect switches and circuit breakers that may be incorporated into the work include the following:

1. General Electric Co.; Electrical Distribution and Control Division.
2. Siemens Energy & Automation, Inc.
3. Square D Co.
4. Eaton, Cutler Hammer.

2.2 DISCONNECT SWITCHES

A. MOTOR SAFETY DISCONNECT SWITCHES

Motor safety disconnect switches shall be provided when the motor starter is not in sight of the associated motor or when shown on the Plans. Motor safety disconnect switches shall be provided with the following specifications.

1. Separately Enclosed Knife Type Switches
 - a. Switches shall not be fused unless specifically shown otherwise on the Plans.
 - b. Switches shall include pad lockable handles, lockable in both the open and closed positions.
 - c. Switches shall be rated at 600 V.
 - d. Switches shall include two auxiliary contacts, rated at 10 A at 250 Vac each, connected to the switch pivot arm that are open when the switch is open, closed when the switch is closed.
 - e. Switches shall be rated at motor horsepower or as per the Plans, whichever is the larger.

- f. Switch enclosures shall be NEMA 4X stainless steel unless specifically stated otherwise in the Plans or through the approval of the Engineer.

2.3 ENCLOSED CIRCUIT BREAKERS

A. ENCLOSED, MOLDED-CASE CIRCUIT BREAKER

NEMA AB 1, with lockable handle in both the open and closed positions.

B. CHARACTERISTICS

Frame size, trip rating, number of poles, and auxiliary devices as indicated on the Plans with interrupting rating to meet available fault current.

- 1. Main and feeder breakers shall be molded case breakers with thermal magnetic trip.
- 2. Motor circuit breakers shall be magnetic only trip with adjustable trip setting.
- 3. Branch circuit breakers shall be molded case, thermal-magnetic trip, trip-free with non-interchangeable, non-adjustable trip unless otherwise noted.

C. APPLICATION LISTING

Appropriate for application, including switching fluorescent lighting loads (SWD) or heating, air-conditioning, and refrigerating equipment (HACR).

D. CIRCUIT BREAKERS, 200 A AND LARGER

- 1. Trip units shall be interchangeable within frame size.
- 2. Assure ability to selectively coordinate circuit breakers.

E. MOLDED-CASE SWITCH

Where indicated, molded-case circuit breaker without trip units.

F. LUGS

Mechanical lugs and power-distribution connectors suitable for copper conductors of the number and size indicated.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install the disconnect switches and circuit breakers level and plumb in locations as indicated, according to manufacturer's written instructions.
- B. Install wiring between disconnect switches, circuit breakers, control, and indication devices.
- C. Connect disconnect switches and circuit breakers and components to wiring system and to ground as indicated and as instructed by manufacturer.
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- D. Identify each disconnect switch and circuit breaker according to requirements specified in Section 16050.

3.2 FIELD QUALITY CONTROL

A. TESTING

1. Prior to Energization

After installing disconnect switches and circuit breakers, perform visual and mechanical inspection of enclosure and devices.

Check connections and mounting for proper torque.

Remove any burrs, filings, or other foreign materials from enclosure. Completely wipe down and vacuum enclosure.

2. After Energization

After electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

Correct malfunctioning units on site where possible and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

***** END OF SECTION *****

SECTION 16415

TRANSFER SWITCHES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section consists of the following types of power transfer switches:

- A. Automatic Transfer Switches.

1.2 RELATED WORKS SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
01600	Materials and Equipment
01800	Testing, Commissioning, and Training
02300	Site Earthwork
Division 3	Concrete
09900	Painting
11000	Equipment General Provisions
Division 15	Mechanical
Division 16	Electrical
16120	Conductors and Cables
16130	Raceway and Boxes

1.3 DEFINITIONS

- A. 3-POSITION, DELAYED TRANSFER

A 3-position “delayed transfer” ATS can be held in the “center” (no load connection) position for a programmable delayed period of time before completing its transfer to the calling position. Delayed transfer applies to transfers in either direction. Delayed transfers can only apply to “Open Transition” switches.

- B. AUTOMATIC TRANSFER SWITCH

Automatic transfer switches shall be defined as power transfer switches used to automatically switch system power away from faulty utility service power to backup generator power then back again to utility power when valid utility power is reacquired.

Automatic transfer switches can be configured for automatic generator starting, waiting for generator stability, then transferring the system bus to the generator. They are also configurable for switching back to utility power under selectable conditions.

Automatic transfer switches can be set up for automatic generator testing and shutdown.

C. CLOSED TRANSITION

A “Closed Transition” ATS provides a “make-before-break” transition when performing automatic generator tests. To make this type of transition, the voltage, frequency, and phase shift between the power sources must be within specified and programmable tolerances. Typical tolerances are $\delta V \leq \pm 5$ percent, $\delta f = \pm 0.2$ percent, and the phase shift between ± 5 electrical degrees. This may take from several seconds to several minutes and is only used during system testing where transition delays are not critical. During power failures, the transitions are “break-before-make” like an open-transfer switch where time delays are minimal.

D. DELAYED TRANSFER

A “Delayed Transfer” ATS provides a programmable delay in the “neutral position.” When in this mode, the load circuit is completely disconnected from both the normal and standby power sources. A delay in this position allows load circuits to dissipate electrical and mechanical energy before being re-energized.

E. NEUTRAL POSITION

The neutral position describes a position of the transfer switch when the load leads are connected to neither the normal nor the standby source. In this position, the load circuit is completely disconnected. This position should not be confused with the neutral bus or with neutral bus switching.

F. NEUTRAL SWITCHING

In a neutral-switching ATS, the neutral load bus is switched between power source neutrals in the same manner as the power leads.

G. NORMAL POSITION

A switch is in its “NORMAL” position when it is connected to the primary (utility) power source.

H. OPEN TRANSITION

An “Open Transition” ATS provides a “break-before-make” transition under all transition conditions.

I. STANDBY POSITION

A switch is in its “STANDBY” position when it is connected to the secondary (generator) power source. This position may also be referred to as the back-up position.

J. TIME DELAY DEFINITIONS

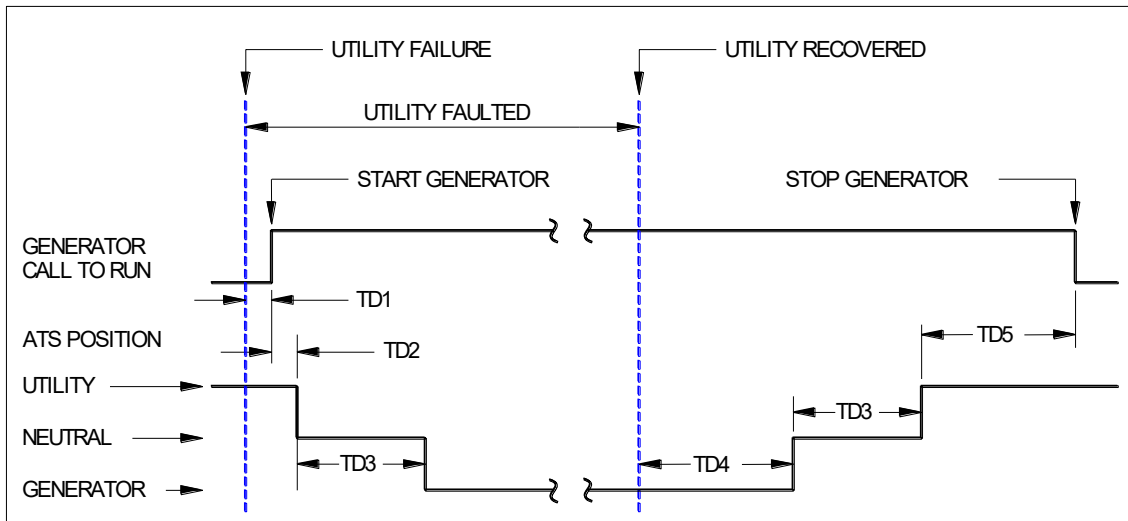
TD1 “Call Delay” is the delay from the ATS sensing faulty utility power and the issue of a generator call to run command.

TD2 “Off Utility Delay” is the delay from the ATS issuing a generator call to run command and the transfer of the ATS away from the “UTILITY” position.

TD3 “Hold Neutral Delay” is the period of time that the ATS will hold the switch in its “neutral” (or “center” or “disconnected”) position when transferring from the “UTILITY” position to the “GENERATOR” position and from the “GENERATOR” back to the “UTILITY” position. In this neutral position, the load side of the ATS is disconnected from both utility and generator power. This delay allows the electronic equipment ample time to dissipate their residual power for proper reapplication of power following a shutdown. This delay only applies to 3-position delayed-transfer switches.

TD4 “Hold Generator Delay” is the delay of the ATS to switch back to utility power after the utility has been sensed as healthy.

TD5 “Cool-Down Delay” is the duration of generator runtime after the ATS has switched back to utility. This cool down period is intended to shut the generator off only after a relaxed cooling period.



3-POSITION SWITCH SIMPLIFIED TIMING DIAGRAM

K. UVTL

Utility Voltage Transition Level.

L. GVTL

Generator Voltage Transition Level.

1.4 SUBMITTALS

Submit four copies of the following:

- A. Manufacturer's Product Data for transfer switches and accessories specified in this Section.
- B. Manufacturer's Product Data for trapped-key interlocks and accessories specified in this Section, and documentation of compatibility with hardware specified under other Sections.
- C. O&M Manual requirements are outlined in Section 01300 and shall also contain the following information:
 1. Two-year maintenance service agreement as described below.
 2. Screenshots and descriptions detailing how to step through the setup and configuration menus.
 3. Field test results as described herein.

1.5 MAINTENANCE

A. ATS

Beginning at the time of Substantial Completion, provide a 24 months full maintenance service performed by skilled employees of the manufacturer's designated service organization. Provide OEM parts and supplies to complete all service to support all factory warranty requirements with written reports to the Owner upon completion of visits.

PART 2 PRODUCTS

2.1 MANUFACTURERS

Subject to compliance with requirements, provide products by the following:

A. TRANSFER SWITCHES

All automatic transfer switches shall be compatible with the selected generator set.

1. General Electric Co.; Electrical Distribution & Control Div.
2. Eaton, Cutler-Hammer.
3. ASCO
4. Kohler
5. Cummins Power Generation/Onan
6. Square D
7. MTU

2.2 PROCUREMENT

- A. The party responsible for the procurement of the automatic transfer switch shall be the single source of responsibility for submittal, products provided, warranty, startup and service purposes.
- B. All automatic transfer switches shall be provided by the contractor that is supplying the generator set as defined in Specification 16230.

- C. The generator and automatic transfer switches may be of different manufacturers.

2.3 AUTOMATIC TRANSFER SWITCHES

A. RATINGS

1. Phases: As shown on the Plans.
2. Poles: As shown on the Plans.
3. Voltage Rating: As shown on the Plans.
4. Current Rating: As shown on the Plans.
5. Fault Current Rating: As shown on the Plans.
6. Neutral: With neutral bus unless indicated otherwise on the Plans.
7. Enclosure: As shown on the Plans.
8. SUSE rated utility disconnect breaker: As Shown on the Plans

B. FEATURES

Reference "DEFINITIONS" in this specification.

1. UL 1008/CSA certification.
2. Open Transition
3. Delayed transfer (3-position) switch, capable of transferring the connected load from its "normal" power source to a "neutral" (disconnected) position for a programmable period of time, then from the "neutral" position to its "standby" power source, and capable of retransferring back to its "normal" power source with mirrored positions and delays.

Delay settings:

Setting	Timing Function ⁽¹⁾	Initial Duration
TD1	Call Delay	1 second
TD2	Off Utility Delay	0 seconds
TD3	Hold Neutral Delay	30 seconds
TD4	Hold Generator Delay	30 minutes
TD5	Cool-Down Delay	5 minutes

(1) Reference "Time Delay Definitions"

4. Power switching shall be provided for all phases.
5. Power sensing shall be provided for all phases.
6. Switch transfer control sensing shall be provided on all phases.
7. Switching mechanism shall be a discrete purpose device specifically designed for Automatic Transfer Switches.
8. Electrically operated by solenoid mechanisms and held by mechanical latches.
9. High current-breaking capacity with silver-surfaced contacts equipped with arc barriers and magnetic blow-out coils.
10. Contacts rated in accordance with UL 1008 for current carrying and switching capabilities.
11. Suitable for repetitive load transfer switching. Minimum 1,000 transfer cycles under full load conditions and minimum 2,000 cycles under no load conditions.
12. Interlocked to prevent supplying the load from more than one source at a time.
13. Adjustable close differential voltage monitoring relays provided on all three phases to sense voltage on the "NORMAL" and "STANDBY" sources.
14. Auxiliary Contacts
 - a. All auxiliary contacts shall be isolated, dry, Form C, suitable for 120V, 10A inductive loads, NEMA B10 rated, wired to easily-accessible terminals in the low voltage control area.

- b. Provide, as a minimum, the following status outputs:
 - i. Switch in utility power position.
 - ii. Switch in generator position.
 - iii. Switch fault.
 - iv. Generator call status. This status signal is one of two identical outputs. One can be directly connected to the generator to call a start operation. The second is electrically isolated from the generator connection and intended for connection to monitoring equipment.
- 15. Molded case service entrance disconnect breaker.
- 16. Intelligent display panel with push-button navigation switches. The display shall be clearly visible in both bright (sunlight) and no light conditions. It shall be visible over an angle of at least 120 degrees. The display panel shall be capable of providing the following functions and capabilities:
 - a. Display source condition information, including AC voltage for each phase of normal source. Voltage for all three phases shall be displayed on a single screen for easy viewing of voltage balance. Line to neutral voltages shall be displayed for 4-wire systems.
 - b. Display source status, to indicate source is connected or not connected.
 - c. Display load data, including 3-phase AC voltage, 3-phase, frequency, kW, and kVA. Voltage and current data for all phases shall be displayed on a single screen.
 - d. The display panel shall allow the operator to view and make the following adjustments in the control system, after entering an access code:
 - i. Set nominal voltage and frequency for the transfer switch.

- ii. Adjust voltage and frequency sensor operation set points.
 - iii. Set up time clock functions.
 - iv. Set up load sequence functions.
 - v. Enable or disable control functions in the transfer switch, including program transition.
 - vi. Set up exercise and load test operation conditions, as well as normal system time delays for transfer time, time delay start, stop, transfer, and retransfer.
- e. Display real time clock data, including date, and time in hours, minutes, and seconds. The real time clock shall incorporate provisions for automatic daylight saving time and leap year adjustments. The control shall also log total operating hours for the control system.
 - f. Display service history for the transfer switch. Display source connected hours, to indicate the total number of hours connected to each source. Display number of times transferred, and total number of times each source has failed.
 - g. Display information for other transfer switches in the system, including transfer switch name, real time load in kW on the transfer switch, current source condition, and current operating mode.
 - h. Display fault history on the transfer switch, including condition, and date and time of fault. Faults to include controller checksum error, low controller DC voltage, ATS fail to close on transfer, ATS fail to close on retransfer, battery charger malfunction, network battery voltage low, and network communications error.

C. OPERATION

- 1. When “normal” voltage falls below invalid UVTL, then
 - a. The ATS starts the generator.

2. When the “standby” voltage is above valid GVTL, then
 - a. After a programmable delay in the “normal” position, the switch transfers from the “normal” position to the “neutral” position.
 - b. After a programmable delay in the “neutral” position, the switch transfers from the “neutral” position to the “standby” position.
3. When “normal” voltage is above valid UVTL, then
 - a. After a programmable delay in the “standby” position, the switch transfers from the “standby” position to the “neutral” position.
 - b. After a programmable delay in the “neutral” position, the switch transfers from the “neutral” position to the “normal” position.
 - c. After the switch returns to the “normal” position, the transfer switch shuts off the generator after a programmable cool down delay.
4. Two separately adjustable time delays prevent transfer and retransfer on voltage dips.
5. Seven-day exercise timer provides periodic exercising of generator.
 - a. Timer is programmable as to day of week, time of day, and duration for exercising.
 - b. Programmable as to whether generator is exercised with or without load being transferred
6. Initially preset the UVTL at:
 - a. Valid \geq 90 percent nominal system voltage
 - b. Invalid \leq 80 percent nominal system voltage
 - c. Relay will pull in at the “valid” level and drop out at the “invalid” level.

7. Initially preset the GVTL at:
 - a. Valid \geq 90 percent nominal system voltage
 - b. Invalid \leq 75 percent nominal system voltage
 - c. Relay will pull in at the “valid” level and drop out at the “invalid” level.
8. Initially preset the utility and generator frequency transition levels at:
 - a. Valid \geq 95 percent of system frequency
 - b. Invalid \geq 90 percent of system frequency

PART 3 EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

Deliver transfer switch components to their final locations in protective wrappings, containers, and other means of protection that will exclude dirt and moisture and prevent damage from construction operations. Remove protection only after equipment is safe from such hazards. Field repair of material or equipment made defective by improper storage or site construction damage by other trades may be cause for rejection of installation.

3.2 INSTALLATION

- A. Install transfer switch per the manufacturer’s installation instructions.
- B. Maintain minimum workspace around unit and components per manufacturer’s installation shop drawings and NFPA 70 NEC.

3.3 IDENTIFICATION

Identify field-installed wiring, components, and provide warning signs as specified in Section 16050.

3.4 GROUNDING

Provide ground continuity to facility electrical ground system as indicated in the Contract Provisions.

3.5 FIELD QUALITY CONTROL

A. ADJUSTING AND PRETESTING

Pretest all system functions, operations, and protective features. Provide all instruments and equipment required for testing. Adjust the time delays, and trip point settings to ensure operation is within accordance to the specifications.

B. FIELD TEST

Test the transfer switch after installation is complete.

1. Advise the Engineer of the test date well in advance so that the test may be witnessed if desired.
2. Perform manufacturer's standard field tests.
3. Provide documented field test results to Owner and Engineer.
4. Provide trip set points and time delays in the O&M manual.

***** END OF SECTION *****

SECTION 16440

PANELBOARDS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section consists of lighting, power, and distribution panelboards, and associated auxiliary equipment rated 600 V and less.

1.2 RELATED WORKS SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
16050	Basic Electrical Materials and Methods
16060	Grounding and Bonding

1.3 SUBMITTALS

Submit under the provisions of Section 01300.

A. PRODUCT DATA

For each type of panelboard, accessory item, and component specified.

B. SHOP DRAWINGS

For panelboards. Include dimensioned plans, sections, and elevations. Show tabulations of installed devices, major features, and voltage rating. Include the following:

1. Enclosure type and mounting.
2. Bus configuration and current ratings.
3. Short-circuit current rating of panelboard.
4. Features, characteristics, ratings, and factory settings of individual protective devices and auxiliary components.

C. PANELBOARD SCHEDULES

For installation in panelboards and inclusion in the maintenance manuals specified in Division 1. Submit final versions prior to closeout of project.

D. MAINTENANCE DATA

For panelboard components to include in the maintenance manuals specified in Division 1. Include manufacturer's written instructions for testing circuit breakers.

1.4 QUALITY ASSURANCE

See Section 16050.

Subject to compliance with requirements, provide products by the following:

A. REFERENCED STANDARDS

1. National Electrical Manufacturers Association (NEMA):
 - a. NEMA 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
 - b. NEMA PB 1, Panelboards.
2. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
3. Underwriters Laboratories, Inc. (UL):
 - a. 50, Standard for Safety Cabinets and Boxes.
 - b. 67, Standard for Safety Panelboards.

1.5 EXTRA MATERIALS

Reference Specification Section 16050 for spare parts.

All panelboards associated with a project shall be the same manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. MANUFACTURERS

Subject to compliance with requirements, provide products by the following:

1. General Electric Co.; Electrical Distribution & Control Div.
2. Eaton, Cutler-Hammer.
3. Siemens Energy & Automation, Inc.
4. Square D Co.

2.2 PANELBOARD FABRICATION

A. MANUFACTURED UNITS

Standards: NEMA PB 1, NFPA 70, UL 50, UL 67.

B. RATINGS

1. Bus current, voltage, number of phases, and number of wires as shown on the Plans.
2. Short Circuit Fault Rating
 - a. 250 Vac or Less

10 kAIC minimum short circuit rating or as indicated on the Plans, whichever is the greater.
 - b. 600 Vac or Less

14 kAIC minimum short circuit rating or as indicated on the Plans, whichever is the greater.
3. Service Entry Equipment rated when indicated on the Plans.

C. BUS BARS

1. Main Bus Bars

- a. Plated drawn copper of 98 percent conductivity sized to limit temperature rise to a maximum of 65 degrees C above an ambient temperature of 40 degrees C.
- b. Drilled and tapped and arranged for sequence phasing of the branch circuit devices.

2. Ground Bus

- a. Ground bus shall be full size (100 percent) rated unless shown otherwise on the Plans.
- b. Ground bus shall be bonded to the box.
- c. Provide additional isolated ground bus when indicated on the Plans.
- d. Compression type connectors.

3. Neutral Bus Bars

- a. Insulated, full size (100 percent) rated unless shown otherwise on the Plans.
- b. Compression type connectors.

D. CONSTRUCTION

1. Interiors shall be factory assembled and designed such that switching and protective devices can be replaced without disturbing adjacent unit and without removing the main bus connectors.

2. Main Lugs

- a. Compression type approved for copper and aluminum.

E. ENCLOSURES

1. Boxes
 - a. Code gauge galvanized steel, furnished without knockouts.
2. Trim Assembly
 - a. Code gauge galvanized steel, finished with rust-inhibited primer and manufacturer's standard paint inside and out.
3. Distribution, Lighting and Appliance Panelboard
 - a. Trims supplied with hinged door over all circuit breaker handles.
 - b. Trims for surface mounted panelboards shall be the same size as the box.
 - c. Trims for flush mounted panelboards shall overlap the box by 3/4 inch on all sides.
 - d. Doors on panelboard front, with concealed hinges, secured with corrosion resistant chrome-plated flush catch and tumbler lock, all keyed alike.
 - e. Nominal 20-inch wide by 5-3/4-inch deep with gutter space in accordance with NEC.
 - f. Clear plastic cover for directory card on the inside of each door.
 - g. Enclosure
 - i. Indoor Wet Locations: NEMA 12 unless stated otherwise on the Plans.
4. Power Distribution Panelboard
 - a. Trims cover all live parts with switching device handles accessible.
 - b. Less than or equal to 12-inches deep with gutter space in accordance with NEC.

- c. Doors on panelboard front, with concealed hinges, secured with corrosion resistant chrome-plated flush catch and tumbler lock, all keyed alike.
- d. Clear plastic cover for directory card on the inside of each door.
- e. Enclosure
 - i. Indoor Wet Locations: NEMA 12 unless stated otherwise on the Plans.

F. SERVICE EQUIPMENT APPROVAL

Listed for use as service equipment for panelboards with main service disconnect.

1. Future Devices

Equip with mounting brackets, bus connections, and necessary appurtenances, for the overcurrent protective device ampere ratings indicated for future installation of devices.

2.3 OVERCURRENT AND SHORT CIRCUIT PROTECTIVE DEVICES

A. MAIN OVERCURRENT PROTECTIVE DEVICE

- 1. Molded-Case Circuit Breaker, NEMA AB 1, handle lockable.
- 2. Vertical mounting unless stated otherwise in the Plans.

B. BRANCH OVERCURRENT PROTECTIVE DEVICES

- 1. Shall be bolt-on molded case circuit breakers
- 2. The minimum breaker size shall be 15 Amp unless stated otherwise on the Plans.
- 3. Characteristics
 - a. Frame size, trip rating, number of poles, and auxiliary devices as indicated on the Plans.
 - b. Fault current rating as defined herein and as indicated on the Plans.

- c. Where branch circuit breakers are shown on the Plans to be GFCI the GFCI shall be Class A (5 mA), sometimes called a “Personal Protection” GFCI.
- 4. Application Listing
 - a. Appropriate for application, including Type SWD for switching fluorescent lighting loads and Type HACR for heating, air-conditioning, and refrigerating equipment.
- 5. Circuit Breakers, 200 A and Larger
 - a. Trip units shall be interchangeable within frame size.
- 6. Circuit breakers, under 200 A
 - a. Thermal-magnetic, trip-free, non-interchangeable, non-adjustable.
- 7. Lugs
 - a. Mechanical lugs and power-distribution connectors for copper conductors of number and size indicated.

PART 3 EXECUTION

3.1 INSTALLATION

Install panelboards and accessory items according to NEMA PB 1.1.

Setup, adjust and fasten in place flush trim and interiors.

Install circuit breakers as shown on the “Panelboard Schedule” for each panelboard. Record all circuit breaker installation deviations from the “Panelboard Schedule” and show on the Record Drawings the actual size and pole position of all circuit breakers installed.

Do not remove knockouts for breaker positions unless a breaker is to be installed (reference EXTRA MATERIALS, UNUSED CIRCUITS in this Section). Where twist outs or knockouts are removed in error, provide a circuit breaker (one pole, 20-ampere) to fill each position removed.

A. MOUNTING HEIGHTS

Top of trim 74 inches above finished floor, unless otherwise indicated.

B. MOUNTING

Plumb and rigid without distortion of box. Mount flush panelboards uniformly flush with wall finish. Provide spacers of neoprene or fiberglass to shim out from irregular surfaces or from damp surfaces.

C. CIRCUIT DIRECTORY

Prepare neatly typewritten panelboards directories in the same pole sequence as the panelboard stamping. Send a copy to the Owner for his records. Prior to typing the final directories, verify room and equipment names and numbers with the Owner and modify circuit descriptions of areas/spaces to conform with the Owner's desires. Obtain approval before installing.

D. PROVISION FOR FUTURE CIRCUITS

Install panelboards in such a manner as to leave access to the box, building chases, knockouts, etc., for future circuit additions. Place conduit in the rear line of knockouts where possible. Install spare conduits from flush-mounted panels up to accessible spaces.

E. WIRING IN PANELBOARD GUTTERS

Run neatly parallel and perpendicular to enclosure. Arrange conductors into groups, and bundle and wrap with wire ties.

3.2 IDENTIFICATION

Identify field-installed wiring and components and provide warning signs as specified in Section 16050.

Label each panelboard with engraved laminated-plastic or metal nameplates mounted with corrosion-resistant screws.

3.3 GROUNDING

Connect equipment grounding conductors to ground bus, except for circuits requiring isolated grounding.

Provide ground continuity to main electrical ground bus as indicated.

3.4 CONNECTIONS

Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Make insulation-resistance tests of each panelboard bus, component, and connecting supply, feeder, and control circuits.
2. Make continuity tests of each circuit.

B. TESTING

1. Prior to Energization

Perform visual and mechanical inspection of panelboard, bus, and breakers.

Check connections and mounting for proper torque.

Remove any burrs, filings, or other foreign materials. Completely wipe down and vacuum panelboard.

2. After Energization

After electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

Correct malfunctioning units on site where possible and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

3.6 ADJUSTING

Set field-adjustable switches and circuit-breaker trip ranges as indicated.

***** END OF SECTION *****

SECTION 16510

INTERIOR LUMINAIRES

PART 1 GENERAL

1.1 SCOPE

This work specified in this Section covers interior lighting devices, including luminaires, lamps, and power supplies, along with lighting accessories and controls; as well as luminaire mounting, installation, lamping, and testing.

1.2 RELATED WORKS SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
16050	Basic Electrical Materials and Methods

1.3 DEFINITIONS

A. BALLAST

The power circuit of a gas-discharge (fluorescent, HID, etc.) lamp. Ballasts are either inductive or electronic.

B. COLOR RENDERING INDEX (CRI)

A figure-of-merit adopted by the Department of Energy that quantifies the color accuracy of lighting devices compared to incandescent light. CRI is normalized such that a score of 100 represents the output of an incandescent lamp.

C. COLOR TEMPERATURE

The color of the light produced by a particular lighting device, measured in kelvin. A higher kelvin temperature results in a “cooler” blue light, while lower kelvin temperatures are “warmer,” and more orange.

D. DIFFUSER

A modifier placed in front of a lamp to change the light intensity and distribution. Part of a LUMINAIRE.

E. DRIVER

The power circuit of an LED LAMP. May be part of a luminaire, or integrated into the lamp itself.

F. EMERGENCY LUMINAIRE

A LUMINAIRE intended to automatically supply illumination to critical areas in the event of failure of the normal supply.

G. ENGINE

See DRIVER in this section.

H. EXIT LIGHT

An illuminated sign or LUMINAIRE intended to indicate the path of egress. An exit light may or may not be an EMERGENCY LUMINAIRE.

I. LAMP

The part of a LUMINAIRE that produces light.

J. LED LAMP

A lamp that uses Light Emitting Diodes (LEDs) to produce useful light. Powered by a DRIVER.

K. LUMEN MAINTENANCE FACTOR

The percent of the rated lumen output of a lamp still available after a specified period of time. A lamp capable of only half of its original output after will have a lumen maintenance factor of 0.50 or **L50**. May be used to specify the performance of a lamp after a particular number of hours, or the number of hours of operation at a particular level.

L. LUMINAIRE

A complete lighting device, exit light, or emergency lighting device. Luminaires consist of one or more LAMPS mounted in a fixture, along with DRIVERS or BALLASTS to power them, and lenses or diffusers to provide the correct lighting distribution.

M. PHOTOCELL

A control device that switches a lighting circuit in response to ambient light level.

1.4 REFERENCES

All applicable ANSI and UL standards.

IES LM-79, LM-80, TM-21.

NFPA 70 [NEC] (latest edition, with Washington State Amendments).

Washington State Energy Code (latest edition).

Washington State Administrative Code [WAC] (current edition).

International Building Code (latest edition, with Washington State Amendments).

1.5 SUBMITTALS

Submit under the provisions of Section 01300.

For each required product, submit data sheets with detailed descriptions of the product to be purchased. Identify each data sheet with the corresponding entry on the Lighting Schedule or Bill of Materials. Where data sheets offer a range of options and accessories, mark or highlight each selection, along with all final part numbers.

A. Submit on each luminaire in the Lighting Schedule. Submittal shall contain the following information, as a minimum:

1. Manufacturer and part number.
2. Product dimensions and weight.
3. Product environmental rating (NEMA rating).
4. Electrical ratings:
 - a. Voltage, Current, and Power
 - b. Power factor
 - c. Efficacy
5. Lighting metrics:
 - a. Lumen output

- b. Lumen maintenance factor at 25,000 hours
 - c. Color temperature
 - d. Color Rendering Index (CRI)
 - e. Lighting distribution
- 6. Regulatory approvals and certifications, including NRTL listing
- 7. Battery and charging data (if applicable).
- B. Submit on all lighting controls (switches, photocells, occupancy sensors, etc.). Submittal shall contain the following information, as a minimum:
 - 1. Manufacturer and part number.
 - 2. Product dimensions and weight.
 - 3. Environmental rating (NEMA rating).
 - 4. Electrical ratings (Voltage, Current, and Power).
 - 5. Regulatory approvals, certifications, and labels.
 - 6. Wiring diagrams showing both factory- and field-installed wiring for the specific application in this Project. Differentiate between factory- and field-installed wiring.
- C. Submit maintenance data for luminaires and lighting controls in the operation and maintenance manual specified in Section 01300.

1.6 QUALITY ASSURANCE

See Section 16050. Coordinate luminaires, mounting hardware, and trim with all other items to be mounted on the ceiling, and all reserved or classified areas, including work of other trades.

1.7 EXTRA MATERIALS

Reference Specification Section 16050 for spare parts.

1.8 WARRANTY

A. WARRANTY

1. The manufacturer shall warrant the materials and workmanship of all luminaires for a minimum of 2 years from the time of Substantial Completion.
2. The warranty shall be comprehensive and shall include all components included in the luminaire package.
3. If during the warranty period the manufacturer refuses to honor a claim due to the actions of the contractor, the contractor shall replace all affected items at no cost to the owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. AVAILABLE MANUFACTURERS

Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include the following:

1. Acuity Brands, Inc.; Holophane, Lithonia, etc.
2. Eaton Corp.
3. GE Lighting
4. OSRAM Sylvania, Inc.

B. "OR EQUAL" PRODUCTS

Luminaires shall be the products specified in the Lighting Schedule in the Plans, or equal. Substitute products shall:

1. Use the same lighting technology (LED, Fluorescent, etc.) as the specified luminaire,
2. Have the same lumen output, color temperature, CRI, and IES distribution,
3. Not have an input wattage greater than 110% of the specified luminaire, and,

4. Have the same environmental ratings.

2.2 LUMINAIRES

A. POWER

1. Luminaires shall be powered at the voltage specified in the Lighting Schedule.
2. Power supplies, including ballasts, drivers, and transformers, shall be self-contained within luminaires.

B. QUALITY

1. MANUFACTURER LABELS AND MARKINGS

The exterior of lenses and diffusers shall have no visible logos, labels, trademarks, or monograms.

2. METAL PARTS

Metal parts shall be free from burrs, scratches, and sharp corners and edges.

3. TRANSMITTING AND REFLECTING SURFACES

Luminaires shall be provided and installed with all transmitting and reflecting surfaces required to produce the same distribution as the luminaires used as the basis of design, as shown in the Lighting Schedule.

4. FINISH

Provide manufacturer's standard finish, except where otherwise indicated, applied over corrosion-resistant treatment or primer. Finish shall be free from streaks, runs, holidays, stains, blisters, and other defects.

C. MAINTENANCE ACCESS

Any parts of luminaires not subject to the manufacturer's warranty shall be accessible for maintenance and owner-replaceable.

D. UV RADIATION

LED Luminaires shall not emit UV radiation

Luminaires fitted with gas discharge lamps shall block at least 99 percent of the UV radiation emitted by the lamps.

E. WET LOCATION LUMINAIRES

Unless otherwise stated in the Plans, luminaires installed in wet locations shall be rated:

1. NEMA 3R where not subject to splashing or hose-directed water.

Contractor shall provide all materials required to obtain labeled environmental ratings.

F. FUSED LUMINAIRES

Provide fused luminaires for applications:

1. Installed more than eight feet above the floor,
2. Powered by 277 V circuits, or,
3. Where required by code.

Install a listed fuse and fuse holder approved for the application by the luminaire manufacturer.

G. EMERGENCY AND BATTERY BACKED LUMINAIRES

All emergency luminaires shall be UL 924 listed. Additionally, emergency luminaires located in classified areas shall be UL 844 listed.

Emergency luminaires shall have the following features:

1. Self-contained internal battery, rated to provide a minimum of 90 minutes of emergency level illumination in the event of a power failure.

H. EXIT LIGHTS

All exit lights shall be UL 924 listed, and shall have the following features:

1. Internal illumination, always on.
2. Illuminated arrow indicating direction of egress.
3. Self-contained internal battery, rated to provide a minimum of 90 minutes of emergency level illumination in the event of a power failure.
4. 120VAC input power unless stated otherwise on the Plans.

2.3 LIGHTING TECHNOLOGIES

Each luminaire shall use the technology specified in the lighting schedule.

A. LED LUMINAIRES

LED Luminaires shall conform to UL 1598 (Luminaires) and UL 8750 (LED Equipment for Use in Lighting Products).

1. Drivers

LED Drivers shall be manufacturer approved for the specific model of luminaire to be installed. Drivers shall meet the following specifications:

- a. UL 8750 listed.
- b. Certified by NRTL acceptable to the State of Washington.
- c. Compliant with FCC Part 15, Class A.
- d. Power Factor: greater than 0.90.
- e. Supply circuit THD: less than 10%.
- f. Temperature Rating: -20 to +40 degrees Celsius.

2. Lamps

LED Lamps shall be an integral part of the luminaire, and rated to last the entire design lifetime of the luminaire. LED lamps shall have the following specifications:

- a. Color Temperature: 4000K, unless otherwise indicated.
- b. CRI: at least 80 CRI.
- c. Lamp Life: at least 60,000 hours, L80.

PART 3 EXECUTION

3.1 INSTALLATION

A. COORDINATION WITH OTHER WORK

- 1. Coordinate lighting with general electrical work, and with other trades.
- 2. Locate luminaires outside of classified areas and reserved electrical space, unless explicitly called for by the Plans.
- 3. Process equipment and piping has priority over lighting. Luminaires shall be placed to avoid conflict with the process and maintenance thereof.
- 4. Heating, Ventilation, and Air Conditioning (HVAC) equipment and ductwork has priority over lighting. Luminaires shall be placed to avoid conflict with HVAC.
- 5. Maintenance vehicle access has priority over lighting. Luminaires shall be placed to not impede maintenance vehicles.
- 6. Luminaires shall be mounted parallel to finished floor or grade, with no tilt angle unless explicitly called for by the Plans.
- 7. Adjust stem or chain lengths to suit field conditions where indicated mounting heights are not feasible.

B. LUMINAIRE SUPPORTS

- 1. Install luminaires with supports, brackets, and trim recommended by the luminaire manufacturer.

2. Bottom of luminaires shall be at the elevation noted in the Plans.
3. Luminaires shall be secured by manufacturer hardware and fasteners. Nails shall not be used to secure luminaires.
4. Supports shall be rated for four times the weight of the luminaire, or 45 kilograms (100 lbs.), whichever is greater. Luminaires weighing more than 23 kilograms (50 lbs.) shall be supported independently from the outlet box.
5. Luminaires shall be supported from building structure or ceiling framing. Provide additional framing to support luminaires that cannot be directly mounted to structural members. Structural integrity shall not be compromised due to installation of luminaires.
6. Hanging luminaires shall be supported at each quarter point and every eight feet, minimum, by hardware that cannot be dislodged by upward force. Pendants and rods over 120 centimeters long (48 inches) shall be braced to limit swinging.
7. Surface-mounted luminaires shall be installed flush and tight to the finished ceiling. Surface-mounted luminaires more than 45-centimeters wide (18 inches) shall be supported at each corner, in addition to the outlet box.

C. INSTALLATION METHODS

1. Unless preempted by other work, luminaires shall be installed at the positions and spacings shown on the Lighting Plan(s). Inform the Engineer of all lighting changes in writing. Plan symbols show the required position of the center of each luminaire, but may be undimensioned.
2. Luminaires in rows or grids shall be installed true to line. Continuous runs of luminaires shall be installed straight and true, with manufacturer's joining hardware.
3. Luminaires located in a common area shall be installed at the same level.

D. ELECTRICAL CONNECTIONS

1. All luminaires shall be grounded.

2. Each luminaire shall be powered by the circuit and operated by the control device(s) shown on the Plans.
3. All luminaires shall be connected according to manufacturer's wiring diagrams.
4. All screw terminals shall be torqued to manufacturer's specifications. If no torque values are published by the manufacturer, terminals shall be torqued to values specified in UL 486A.
5. All luminaires (except emergency luminaires and exit luminaires) shall be fitted with NEC 410.130(G)-type luminaire disconnect plugs. Ideal PowerPlug or equal.
6. Emergency and battery-backed luminaires shall be supplied by both switched lighting conductors AND unswitched charging conductors, powered by the same circuit.
7. Power conductors to exit lights shall not be switched.

E. LIGHTING CONTROLS

Lighting controls shall be installed according to the Plans.

F. ENVIRONMENTAL RATINGS

Installation of luminaires shall meet all manufacturer requirements to maintain labeled environmental ratings.

G. CLEANING

Thoroughly clean dirt and debris from all internal and external surfaces. Vacuum interior of luminaires after installation.

Prior to commissioning, wipe all transmitting and reflecting surfaces with damp cloth.

H. SAFE DISPOSAL

Disposal of lamps and luminaires containing hazardous materials (mercury, etc.) shall comply with state and local rules.

3.2 FIELD QUALITY CONTROL

A. DAMAGED LUMINAIRES

During commissioning, Contractor shall inspect each installed luminaire for damage. Damaged luminaires and components shall be replaced at no cost to the owner. Contractor shall replace any transmitting or reflecting surface that is scratched, shattered, or otherwise damaged before completion of work at no cost to the owner.

Metal parts that demonstrate corrosion during the project warranty period shall be replaced at no cost to the owner.

Contractor shall provide replacements for any lamps that fail prior to completion of work.

B. TESTING

Contractor shall demonstrate normal operation of each luminaire. Contractor shall interrupt electrical power to demonstrate proper operation of emergency luminaires.

Malfunctioning luminaires and components shall be repaired or replaced, then tested again.

Contractor shall demonstrate each lighting control to show correct operation, and repair or replace malfunctioning controls.

*****END OF SECTION*****

SECTION 16520

EXTERIOR LUMINAIRES

PART 1 GENERAL

1.1 SUMMARY

The work specified in this Section covers exterior lighting devices, including luminaires, lamps, and power supplies; along with outdoor lighting accessories and controls; as well as outdoor mounting hardware, light poles, and accessories; and luminaire mounting, installation, lamping and testing.

1.2 RELATED SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
16050	Basic Electrical Materials and Methods

1.3 DEFINITIONS

A. BALLAST

The power circuit of a gas-discharge (fluorescent, HID, etc.) lamp. Ballasts are either inductive or electronic.

B. DRIVER

The power circuit of an LED Lamp. May be part of a luminaire, or integrated into the lamp itself.

C. EXTERIOR LUMINAIRE

Any LUMINAIRE mounted in an OUTDOOR AREA (as defined in Specification Section 16050).

D. LAMP

The part of a LUMINAIRE that produces light.

E. LED LAMP

A lamp that uses an array of Light Emitting Diodes (LEDs) to produce useful light. Powered by a DRIVER.

F. LUMEN MAINTENANCE FACTOR

The percent of the rated lumen output of a lamp still available after a specified period of time. A lamp capable of only half of its original output after will have a lumen maintenance factor of 0.50 or **L50**.

G. LUMINAIRE

A complete lighting device, exit light, or emergency lighting device. Luminaires consist of one or more LAMPS mounted in a fixture, along with DRIVERS or BALLASTS to power them, and lenses or diffusers to provide the correct lighting distribution.

H. PHOTOCELL

A control device that switches a lighting circuit in response to ambient light level.

1.4 REFERENCES

All applicable ANSI standards.

American Association of State Highway and Transportation Officials [AASHTO]

UL 844, 924, 935, 1029, 1598, 8750.

IES LM-79, LM-80, TM-21.

NFPA 70 [NEC] (latest edition, with Washington State Amendments).

Washington State Energy Code (latest edition).

Washington State Administrative Code [WAC] (current edition).

International Building Code (latest edition, with Washington State Amendments).

1.5 SUBMITTALS

Submit under the provisions of Section 01300.

For each required product, submit data sheets with detailed descriptions of the product to be purchased. Identify each data sheet with the corresponding entry on the Lighting Schedule or Bill of Materials. Where data sheets offer a range of options and accessories, mark or highlight each selection, along with all final part numbers.

- A. Submit on each luminaire in the Lighting Schedule. Submittal shall contain the following information, as a minimum:
1. Manufacturer and part number.
 2. Product dimensions and weight.
 3. Environmental rating (NEMA rating).
 4. Electrical ratings:
 - a. Voltage, Current, and Power
 - b. Power factor
 - c. Efficacy
 5. Lighting metrics:
 - a. Lumen output
 - b. Lumen maintenance factor
 - c. Color temperature
 - d. Color Rendering Index (CRI)
 - e. Lighting distribution
 6. Regulatory approvals, certifications, and labels.
- B. Submit on all lighting controls (photocells, motion detectors, etc.). Submittal shall contain the following information, as a minimum:
1. Manufacturer and part number.
 2. Product dimensions and weight.
 3. Environmental rating (NEMA rating).
 4. Electrical ratings (Voltage, Current, and Power).
 5. For luminaires to be mounted on poles:

- a. Effective Projected Area (EPA)
 - 6. Regulatory approvals, certifications, and labels.
 - 7. Detailed wiring diagrams showing both factory- and field-installed wiring for the specific application in this Project. Differentiate between factory- and field-installed wiring.
- C. Submit maintenance data for luminaires and lighting controls in the operation and maintenance manual specified in Section 01300.

1.6 QUALITY ASSURANCE

See Section 16050. Coordinate luminaires, mounting hardware, light poles with all other items to be mounted on the exterior of buildings, or on the facility grounds, including the work of other trades.

1.7 EXTRA MATERIALS

Reference Specification Section 16050 for spare parts.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. AVAILABLE MANUFACTURERS

Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include the following:

- 1. Acuity Brands, Inc.; Holophane, Lithonia, etc.
- 2. Eaton Corp.; Crouse-Hinds, Cooper
- 3. GE Lighting
- 4. OSRAM Sylvania, Inc.

B. "OR EQUAL" PRODUCTS

Luminaires shall be the products specified in the Lighting Schedule in the Plans, or equal. Substitute products shall:

- 1. Use the same lighting technology (LED, Fluorescent, etc.) as the specified luminaire,

2. Have the same lumen output, CRI, and IES distribution,
3. Not have an input wattage greater than 110 percent of the specified luminaire, and,
4. Have the same environmental rating.

2.2 LUMINAIRES

A. POWER

1. Luminaires shall be powered at the voltage specified in the Lighting Schedule.
2. Power supplies, including ballasts, drivers, and transformers, shall be self-contained within luminaires.

B. QUALITY

1. Manufacturer Labels and Markings

The exterior of lenses and diffusers shall have no visible logos, labels, trademarks, or monograms.

2. Metal Parts

- a. Metal parts shall be free from burrs, scratches, and sharp corners and edges.
- b. Sheet metal components shall be corrosion-resistant aluminum, except as otherwise indicated. Sheet metal shall be formed and supported to prevent warping and sagging.
- c. Exposed structural metal shall be stainless steel.

3. Reflecting Surfaces

Minimum reflectance shall be as follows, except as otherwise indicated:

- a. White surfaces: 85 percent.
- b. Specular surfaces: 83 percent.

- c. Diffusing specular surfaces: 75 percent.
- d. Laminated silver metallized film: 90 percent.

4. Transmitting Surfaces

Transmitting surfaces (including lenses, diffusers, covers, globes, etc.) shall be 100 percent acrylic plastic or water-white, annealed crystal glass, except as otherwise indicated.

a. Plastic

High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

b. Lens Thickness

Minimum 3mm (1/8 inch), except where greater thickness is specified.

5. Finish

Provide manufacturer's standard finish, except where otherwise indicated, applied over corrosion-resistant treatment or primer. Finish shall be free from streaks, runs, holidays, stains, blisters, and other defects.

C. HOUSING

- 1. Luminaire housings shall be rigidly-formed, light-tight enclosures that will not warp, sag, or deform with use.
- 2. Luminaire housings shall have one of the following environmental ratings:
 - a. NEMA 3R where not subject to splashing or hose-directed water.
- 3. Contractor shall provide all materials required to obtain labeled environmental ratings.

D. FUSED LUMINAIRES

Provide fused luminaires for applications:

1. Installed more than eight feet above the floor,
2. Powered by 277 V circuits, or,
3. Where required by code.

Install a listed fuse and fuse holder approved for the application by the luminaire manufacturer.

2.3 LIGHTING TECHNOLOGIES

Each luminaire shall use the technology specified in the lighting schedule.

A. LED LUMINAIRES

LED Luminaires shall conform to UL 1598 (Luminaires) and UL 8750 (LED Equipment for Use in Lighting Products). LED luminaires shall have a manufacturer warranty of at least two years.

1. Drivers

LED Drivers shall be manufacturer approved for the specific model of luminaire to be installed. Drivers shall meet the following specifications:

- a. UL 8750 listed.
- b. Certified by NRTL acceptable to the State of Washington.
- c. Compliant with FCC Part 15, Class A.
- d. Power Factor: greater than 0.90.
- e. Supply circuit THD: less than 10%.
- f. Temperature Rating: -20 to +40 degrees Celsius.

2. Lamps

LED Lamps shall be an integral part of the luminaire, and rated to last the entire design lifetime of the luminaire. LED lamps shall have the following specifications:

- a. Color Temperature: 4000K, unless otherwise indicated.
- b. CRI: at least 80 CRI.
- c. Lamp Life: at least 60,000 hours, L80.

PART 3 EXECUTION

3.1 INSTALLATION

A. COORDINATION WITH OTHER WORK

- 1. Coordinate lighting with general electrical work, and with other trades.
- 2. Locate luminaires outside of classified areas and reserved electrical space, unless explicitly called for by the Plans.
- 3. Process equipment and piping has priority over lighting. Luminaires shall be placed to avoid conflict with the process and maintenance thereof.
- 4. Heating, Ventilation, and Air Conditioning (HVAC) equipment and ductwork has priority over lighting. Luminaires shall be placed to avoid conflict with HVAC.
- 5. Vehicle access has priority over lighting. Luminaires shall be placed to maintain required clearance above right-of-way.
- 6. Adjust mounting heights to suit field conditions where indicated heights are not feasible.

B. LUMINAIRE SUPPORTS

- 1. Install luminaires with supports, brackets, and trim recommended by the luminaire manufacturer.
- 2. Luminaires shall be secured by manufacturer hardware. Nails shall not be used to secure luminaires.

C. INSTALLATION METHODS

1. Unless preempted by other work, luminaires shall be installed at the positions and spacings shown on the Lighting Plan(s). Inform the Engineer of all lighting changes in writing. Plan symbols show the required position of the center of each luminaire but may be un-dimensioned.
2. Luminaires in rows or grids shall be installed true to line. Continuous runs of luminaires shall be installed straight and true, with manufacturer's joining hardware.
3. Luminaires located in a common area shall be installed at the same level.

D. ELECTRICAL CONNECTIONS

1. All luminaires and light poles shall be grounded.
2. Each luminaire shall be powered by the circuit and operated by the control device(s) shown on the Plans.
3. All luminaires shall be connected according to manufacturer's wiring diagrams.

3.2 FIELD QUALITY CONTROL

A. DAMAGED HARDWARE

During commissioning, Contractor shall inspect each lighting device. Damaged luminaires, supports, and components shall be replaced at no cost to the owner. Contractor shall replace any transmitting or reflecting surface that is scratched, shattered, or otherwise damaged before completion of work at no cost to the owner.

Metal parts that demonstrate corrosion during the project warranty period shall be replaced at no cost to the owner.

Contractor shall provide replacements for any lamps that fail prior to completion of work.

B. TESTING

Contractor shall demonstrate normal operation of each luminaire.
Contractor shall interrupt electrical power to demonstrate proper operation of emergency luminaires.

Malfunctioning luminaires and components shall be repaired or replaced, then tested again.

Contractor shall demonstrate each lighting control to show correct operation, and repair or replace malfunctioning controls.

***** END OF SECTION *****

PART 5

WAGE RATES

PART 6

APPENDIX

APPENDIX A

SUPPLEMENTAL BIDDER RESPONSIBILITY CRITERIA

APPENDIX A

SUPPLEMENTAL BIDDER RESPONSIBILITY CRITERIA FORMS VUECREST RESERVOIR AND BOOSTER STATION

These forms shall be completed in their entirety and submitted by the apparent two lowest Bidders to the Mason County PUD No. 1 by 12:00 p.m. (noon) of the second business day following the bid submittal deadline.

Failure to submit and meet the requirements as stated in Section 2.01.8 of the General Conditions shall be grounds for rejection of the bid. The Mason County PUD No. 1 will be the sole judge in determining if the prospective contractor meets the minimum experience requirements.

Contractor:

Name: _____

Address: _____

Phone: _____

Contact Person: _____

2. Delinquent State Taxes

Instructions to Bidders: Check the appropriate box

- ☐ The Bidder does not owe delinquent taxes to the Washington State Department of Revenue.
- ☐ Alternatively, the Bidder does owe delinquent taxes to the Washington State Department of Revenue.

If the Bidder owes delinquent taxes, they must submit a written payment plan approved by the Department of Revenue, to the Contracting Agency.

(Date)

(Signature)

(Print Name)

(Title)

3. Claims Against Retainage and Bonds:

Instructions to Bidders: Check the appropriate box

- ☐ The Bidder has not had claims against retainage and bonds in the 3 years prior to the bid submittal date.
- ☐ Alternatively, the Bidder has had claims against retainage and bonds in the 3 years prior to the bid submittal date.

If the Bidder has had claims against retainage and bonds in the 3 years prior to the bid submittal date, submit a list of public works projects completed during this period that have had claims against retainage and bonds and include name of Project, contact information for the Owner, a list of claims filed against retainage and/or payment bond for any of the projects listed; and a written explanation of circumstances surrounding each claim and the ultimate resolution of the claim.

(Date)

(Signature)

(Print Name)

(Title)

4. Public Bidding Crime:

Instructions to Bidders: Check the appropriate box

- ☐ The undersigned certifies that the Bidder and/or its Owners have not been convicted of a crime involving bidding on a public works contract in the 5 years prior to the bid submittal date.
- ☐ Alternatively, the undersigned confirms that the Bidder and/or its Owners have been convicted of a crime involving bidding on a public works contract in the 5 years prior to the bid submittal date.

If the Bidder and/or its Owners have been convicted of a crime involving bidding on a public works contract, provide a written explanation identifying the date of the conviction and a description of the circumstances surrounding the conviction.

(Date)

(Signature)

(Print Name)

(Title)

5. Termination for Cause/Termination for Default

Instructions to Bidders: Check the appropriate box

- ☐ The undersigned certifies that the Bidder has not had any public works contracts terminated for cause or terminated for default by a government agency in the 5 years prior to the bid submittal date.
- ☐ Alternatively, the undersigned confirms that the Bidder has had public works contracts terminated for cause or terminated for default by a government agency in the 5 years prior to the bid submittal date.

If the Bidder has had any public works contracts terminated for cause or terminated for default in the 5 years prior to the bid submittal date, provide a written explanation for all contracts terminated for cause or terminated for default by identifying the project contract that was terminated, the government agency which terminated the Contract, the date of the termination, and a description of the circumstances surrounding the termination.

(Date)

(Signature)

(Print Name)

(Title)

6. Lawsuits

Instructions to Bidders: Check the appropriate box

- ☐ The undersigned certifies that the Bidder has not had any lawsuits with judgments entered against the Bidder in the 5 years prior to the bid submittal date that demonstrate a pattern of failing to meet the terms of contracts.
- ☐ Alternatively, the undersigned confirms that the Bidder has had any lawsuits with judgments entered against the Bidder in the 5 years prior to the bid submittal date that demonstrate a pattern of failing to meet the terms of contracts.

If the Bidder has had any lawsuits with judgments entered against the Bidder in the 5 years prior to the bid submittal date that demonstrate a pattern of failing to meet the terms of contracts, submit a list of lawsuits along with a written explanation of the circumstances surrounding each lawsuit. The Contracting Agency shall evaluate these explanations to determine whether the lawsuits demonstrate a pattern of failing to meet the terms of contracts.

(Date)

(Signature)

(Print Name)

(Title)

7. Contract Time (Liquidated Damages)

Instructions to Bidders: Check the appropriate box

- ☐ The undersigned certifies that the Bidder has not had liquidated damages assessed on any project it has completed in the 5 years prior to the bid submittal date.
- ☐ Alternatively, the undersigned confirms that the Bidder has had liquidated damages assessed on projects in the 5 years prior to the bid submittal date.

If the Bidder has had liquidated damages assessed against projects in the 5 years prior to the bid submittal dated, submit a list of projects along with Owner contact information, and number of days assessed liquidated damages. The Contracting Agency shall determine whether the Contractor has a pattern of failing to complete projects within Contract Time.

(Date)

(Signature)

(Print Name)

(Title)

8. Capacity and Experience

The Bidder shall have sufficient current capacity and the Project Superintendent assigned to the Project shall have experience to meet the requirements of this Project. The Bidder and Project Superintendent shall have successfully completed at least two projects as the prime contractor, of a similar size and scope, during the 5-year period immediately preceding the bid submittal deadline for this project. Similar size is defined as a minimum of 70 percent of the bid amount submitted by the Bidder.

A. Capacity

- i. Gross dollar amount of work currently under contract:

- ii. Gross dollar amount of contracts currently not completed:

- iii. List five major pieces of equipment which are anticipated to be used on this project by the Contractor and note which items are owned by the Contractor and which are to be leased or rented from others:

- iv. Number of superintendents on Bidder's staff:

B. Experience

- i. General character of work performed by firm:

- ii. Identify who will be the superintendent on this project and years of experience. Also, list the number of years this person has been with your firm.

- iii. Similar Size and Scope Projects Completed in the Past 5 Years

#1 Owner's Name and Contact Information: _____

Owner is a Government Agency? ____ Yes ____ No

Superintendent's Name: _____

Project Name: _____

Awarded Contract Amount: _____

Final Contract Amount: _____

Completion Date: _____

Project Description: _____

#2 Owner's Name and Contact Information: _____

Owner is a Government Agency? ____ Yes ____ No

Superintendent's Name: _____

Project Name: _____

Awarded Contract Amount: _____

Final Contract Amount: _____

Completion Date: _____

Project Description: _____

#3 Owner's Name and Contact Information: _____

Owner is a Government Agency? ____ Yes ____ No

Superintendent's Name: _____

Project Name: _____

Awarded Contract Amount: _____

Final Contract Amount: _____

Completion Date: _____

Project Description: _____

APPENDIX B

TEMPORARY CONSTRUCTION PERMITS

APPENDIX C

BORING LOGS
(FOR INFORMATION ONLY)



July 21, 2021

Mason County PUD 1
North 21971 Hwy. 101
Shelton, Washington 98584
Attention: Brandy Milroy

Report
Geotechnical Assessment
Parcel No. 32105-76-90011
Union, Washington
Project No. 1171-002-01

INTRODUCTION

Insight Geologic is pleased to provide this report of our investigation of subsurface conditions at the site of your proposed 24,000-gallon capacity water tank. We understand that Mason County PUD 1 is looking to install the water tank to serve the Vuecrest water system in Union, Washington. The proposed location of the water tank installation is the northwest portion of Mason County parcel no. 32105-76-90011 which is accessed from East Ridgecrest Drive North. The location of the property is shown relative to surrounding physical features in the Vicinity Map, Figure 1.

We understand that the proposed water tank is to be 20 feet in diameter with a height of 10 feet. Soil loads by the structure are estimated to be on the order of 1,000 pounds per square foot. The proposed location of the tank is at the top of a low hill on the parcel which may contain slopes that meet the definition of Landslide Hazard Areas under Mason County's Critical Areas Ordinance for Geologically Hazardous Areas.

SCOPE OF SERVICES

The purpose of our services was to evaluate subsurface conditions in the area of the proposed concrete tank with regard to geotechnical parameters and evaluate the slopes as potential landslide hazard areas. We performed our evaluation in general accordance with the procedures outlined in Mason County's Critical Areas Ordinance. The specific tasks performed for this project are outlined below:

1. Conducted a site reconnaissance to evaluate and mark proposed test pit locations.
2. Excavated four exploratory test pits in the areas of the proposed water tank using a small, track-mounted excavator. The test pits were excavated to a depth of approximately 3.5 feet below ground surface when the underlying glacial till unit was encountered.
3. Collected representative soil samples from the test pits for laboratory analysis.

4. Logged the soils exposed in the test pits in general accordance with ASTM D2487-06.
5. Provided for laboratory testing of selected soil samples for grain size analysis to be used for soil classification.
6. Conducted a geological assessment of the steep slope with respect to potential landslide and erosion hazards in general accordance with Mason County's Critical Areas Ordinance Chapter 8.52.
7. Prepared a report summarizing our field activities including our recommendations for bearing capacity, earth pressures, and structural fill as well as our opinion of slope stability.

GEOLOGICALLY HAZARDOUS AREAS

The regulations established in the Mason County Resource Ordinance, Title 8, Chapter 8.52 Geologically Hazardous Areas are intended to "identify areas that present potential dangers to public health and safety, to prevent the acceleration of natural geological hazards, to address off-site impacts, and to minimize the risk to the property owner or adjacent property owners from development activities." Pertinent landslide and erosion hazard issues related to the site are addressed in the remainder of this report.

The purpose of this study and report is to evaluate the slope stability of the site in accordance with Mason County Resource Ordinance, Title 8, and Chapter 8.52. "Geologically Hazardous Areas" means those areas with any indications of earth movement such as debris slides, earth flows, slumps and rock falls; areas with artificial over-steepened or unengineered slopes; areas containing soft or liquefiable soils; areas over-steepened or otherwise unstable as a result of stream incision, stream bank erosion and undercutting by wave action; slopes greater than 15 percent (8.5 degrees) or having the following: a.) hillsides intersecting geologic contacts with relatively permeable sediment overlying relatively impermeable sediment or bedrock and having springs or groundwater seepage; b.) any area with a slope of 40 percent (21.8 degrees), or steeper and a vertical relief of ten or more feet, except areas composed of consolidated rock.

Surface Conditions

The project site consists of Lot 1A, located on the northwest corner of Mason County parcel no. 32105-76-90011 consisting of approximately 1.3 acres and is roughly rectangular in shape. The site is bounded by undeveloped residential properties and accessed by the north end of East Ridgecrest Drive North. Topographically, the parcel is situated on the west facing slope that descends to Hood Canal at the base of the slope. The eastern half of the parcel consist of a relatively gently sloping upland portion of the site situated at an elevation of approximately 510 feet above mean sea level (MSL). This upland area has an identified slope of approximately 10 to 25 percent to the east. The remainder of the parcel descends to the west along a series of slopes that range from 55 to 70 percent to an elevation of approximately 350 feet MSL along the west edge of the parcel. The property is wooded with fir and cedar trees and a moderate understory of shrubby evergreen plants, sword fern, and blackberry.

Geology

We reviewed the Washington State Department of Natural Resources (DNR) Interactive Geologic Map (<https://geologyportal.dnr.wa.gov/>) to evaluate the geology of the area and landslide potential. Based on our review, the site appears to be underlain by Vashon age glacial till deposits which overlie Vashon age advance outwash deposits. The glacial till material is described as very dense, poorly-sorted silty, fine to coarse sand, with gravel and occasional boulders. The advance outwash is described as generally well-sorted sand and gravel. The sediments were deposited and overridden by glacial actions during the last advance of the most recent glacial period in the Puget Sound and has been glacially consolidated. No upland wetlands were identified by Mason County within 1,500 feet of the site.

The closest landslide deposit mapped by the Washington State Department of Natural Resources Division of Geology and Earth Resources Coastal Landslide Mapping Project is located approximately 900 feet to the southwest of the site. The landslide is located near the toe of the slope and within Pre-Fraser Olympic-source glacial and nonglacial deposits stratigraphically below the Vashon age advance outwash deposits located on the site and do not represent soils located at the subject site.

FINDINGS

General

Site Exploration

We excavated four test pits in the locations as shown on the Site Plan, Figure 2. A geologist from Insight Geologic maintained a log of the conditions encountered. The test pits were completed to the depth of between 1 and 3.5 feet below ground surface. The test pits were terminated after encountering the underlying glacial till. The soils were visually classified in general accordance with the system described in ASTM D2487-06. The exploration logs are contained in Attachment B.

Soil

Soil conditions encountered in the test pits were generally consistent between exploration locations. Underlying approximately 0.5 feet of forest duff we encountered between 0.5 to 2.5 feet of weathered till soils consisting of brown to red brown well to poorly graded gravel with sand and silt to red-brown silty sand with gravel (GP-GM, GW-GM, SM) in a medium dense and moist condition. Underlying this surficial unit, we encountered undisturbed glacial till which consisted of similar material in a very dense condition to the base of the test pits. A generalized geologic cross section is shown in Figure 3.

The surficial soils encountered are consistent with Alderwood gravelly sandy loam, which is mapped for the area. These soils are generally formed from glacial till and generally have restrictive layers occurring at depths of 2 to 3 feet below grade. Permeability is moderately rapid above the restrictive layer and very low within the restrictive layer, runoff is medium to rapid depending on slope, and the hazard of water erosion is moderate to rapid depending on slope.

Groundwater

Groundwater was not encountered in any of the test pits at the subject site. In addition, no seeps were identified along the slopes leading that drain to the west and east. It is likely that during periods of heavy rainfall limited perched groundwater temporarily develops along the underlying glacial till contact before draining from the site.

Laboratory Testing

We selected four soil samples for gradation analyses in general accordance with ASTM D422 to define soil class and assist with geotechnical recommendations. Our geotechnical laboratory test results are provided in Attachment B.

SEISMIC DESIGN CONSIDERATIONS

General

We understand that seismic design will likely be performed using the 2018 IBC standards. The following parameters may be used in computing seismic base shear forces:

Table 1. 2018 IBC Seismic Design Parameters

Spectral Response Accel. at Short Periods (S_S) = 1.555
Spectral Response Accel. at 1 Second Periods (S_1) = 0.582
Site Class = C
Site Coefficient (F_A) = 1.2
Site Coefficient (F_V) = 1.418

Ground Rupture

Because of the location of the site with respect to the nearest known active crustal faults, and the presence of a layer of glacial till deposits, it is our opinion that the risk of ground rupture at the site due to surface faulting is low.

Soil Liquefaction

Liquefaction refers to a condition where vibration or shaking of the ground, usually from earthquake forces, results in the development of excess pore water pressures in saturated soils, and a subsequent loss of stiffness in the soil occurs. Liquefaction also causes a temporary reduction of soil shear strength and bearing capacity, which can cause settlement of the ground surface above the liquefied soil layers. In general, soils that are most susceptible to liquefaction include loose to medium dense, clean to silty sands and non-plastic silts.

Based on our review of the Washington State Department of Natural Resources (DNR) Interactive Geologic Map, the project site is identified to have a low potential risk for soil liquefaction. Based on our experience with detailed seismic studies in the project area, including areas that are mapped within the same till soil deposits as the project site, we concur with the reviewed map.

Seismic Compression

Seismic compression is defined as the accrual of contractive volumetric strains in unsaturated soils during strong shaking from earthquakes (Stewart et al., 2004). Loose to medium dense clean sands and non-plastic silts are particularly prone to seismic compression settlement. Seismic compression settlement is most prevalent on slopes, but it can also occur on flat ground. It is our opinion that the glacial till soils at the site have a low risk for seismic compression settlement.

Seismic Settlement Discussion

Based on the materials encountered in our explorations, it is our preliminary opinion that seismic settlements (liquefaction-induced plus seismic compression) could potentially total a few inches at the site as the result of an IBC design level earthquake.

Seismic Slope Instability

The maximum slope inclination of the site approximately 70 percent, however we did not observe signs of slope instability during our site visit. In our opinion, there is a low risk of seismic slope instability at the project site under current conditions.

Lateral Spreading

Lateral spreading involves the lateral displacement of surficial blocks of non-liquefied soil when an underlying soil layer liquefies. Lateral spreading generally develops in areas where sloping ground or large grade changes are present. Based on our understanding of the subsurface conditions at the site, it is our opinion that there is a low risk for the development of lateral spreading as a result of an IBC design level earthquake.

CONCLUSIONS AND RECOMENDATIONS

General

Based on the results of our review, subsurface explorations and engineering analyses, it is our opinion that the proposed structure is feasible from a geotechnical standpoint. We understand that the proposed addition of a 30,000-gallon capacity water tank structure will be supported on a concrete mat foundation. We recommend that the foundation is designed using an allowable soil bearing capacity of 4,000 pounds per square foot (psf) if the foundation is supported by the glacial till unit at the site.

The soils encountered in our explorations are typically in a medium dense condition near ground surface. To limit the potential for structure settlement, we recommend that the tank slab be established on the underlying very dense glacial till. If the base of the proposed concrete mat foundation is not founded on the underlying glacial till we recommend removing the unconsolidated surficial soils to the top of the glacial till horizon and replacing it with a minimum 12-inch thick layer of compacted structural fill extending a minimum of 1 foot beyond the edge of the slab. A completed Geotechnical Report Checklist is attached, Attachment C. Proposed development areas are shown on Figure 4.

Geologically Hazardous Areas

Based on the site visit observations and published information of soils in the area of subject parcel, it is our opinion that the steep slopes of the subject site meet the definition of a "Geologically

Hazardous Area” due to the angle of the measured slopes. The slopes located west of the proposed development area exceed the 40 percent inclination criteria as outlined in the Mason County Resource Ordinance. The remainder of the slopes on the property are all less than about 40 percent and do not exhibit geologic contacts, springs or seeps as outlined in the ordinance. No evidence of past landslides was observed.

Based on Mason County’s Critical Areas Ordinance, the required prescriptive buffer for the property would be a 50-foot setback from the edges of the Geologically Hazardous Areas. However, based on our evaluation and understanding of the project, it is our opinion that the slopes are stable in their current condition and construction activities are unlikely to negatively impact on-site or off-site slope conditions. The project area is underlain by a thin unit of soil overlying very dense glacial till soils. The glacial till has a high bearing capacity and is not prone to deep-seated failure. Based on provided information the weight of the water tank when fully loaded will be approximately 450,000 pounds. Excavation for the proposed footing and other earthwork activities will remove approximately 150,000 pounds of soil from the proposed building area. Therefore, it is our opinion that the geologically hazardous areas buffer may be reduced to a width of 30 feet from the top and base of the slopes. No other setbacks are required. Geologically hazardous areas and buffers are shown in Figure 4.

Earthwork

General

We anticipate that site development earthwork will include removing existing vegetation, stripping sod/topsoil materials, preparing subgrades, excavating for utility trenches, and placing and compacting structural fill. We expect that the majority of site grading can be accomplished with conventional earthmoving equipment in proper working order.

Our explorations did not encounter appreciable amounts of debris or unsuitable soils associated with past site development. Still, it is possible that concrete slabs, abandoned utility lines or other development features could be encountered during construction. The contractor should be prepared to deal with these conditions.

Clearing and Stripping

Clearing and stripping should consist of removing surface and subsurface deleterious materials including sod/topsoil, trees, brush, debris and other unsuitable loose/soft or organic materials. Stripping and clearing should extend at least 5 feet beyond all structures and areas to receive structural fill.

We estimate that a stripping depth of about 6 inches will be required to remove the forest duff encountered in our explorations. Deeper stripping depths may be required if additional unsuitable soils are exposed during stripping operations. We recommend that trees be removed by overturning so that the majority of roots are also removed. Depressions created by tree or stump removal should be backfilled with structural fill and properly compacted.

Native vegetation should be maintained whenever possible and exposed soil protected from rainfall. Detailed clearing and grading plans and temporary erosion control plans should be prepared and submitted by an appropriate contractor.

Subgrade Preparation

After stripping and excavating to the proposed subgrade elevation, and before placing structural fill or foundation concrete, the exposed subgrade should be thoroughly compacted to a firm and unyielding condition. The exposed subgrade should then be proof-rolled using loaded, rubber-tired heavy equipment. We recommend that Insight Geologic be retained to observe the proof-rolling prior to placement of structural fill or foundation concrete. Areas of limited access that cannot be proof-rolled can be evaluated using a steel probe rod. If soft or otherwise unsuitable areas are revealed during proof-rolling or probing, that cannot be compacted to a stable and uniformly firm condition, we generally recommend that: 1) the subgrade soils be scarified (e.g., with a ripper or farmer's disc), aerated and recompacted; or 2) the unsuitable soils be overexcavated and replaced with structural fill.

Temporary Excavations and Groundwater Handling

Excavations deeper than 4 feet should be shored or laid back at a stable slope if workers are required to enter. Shoring and temporary slope inclinations must conform to the provisions of Title 296 Washington Administrative Code (WAC), Part N, "Excavation, Trenching and Shoring." Regardless of the soil type encountered in the excavation, shoring, trench boxes or sloped sidewalls will be required under the Washington Industrial Safety and Health Act (WISHA). The contract documents should specify that the contractor is responsible for selecting excavation and dewatering methods, monitoring the excavations for safety and providing shoring, as required, to protect personnel and structures.

In general, temporary cut slopes should be inclined no steeper than about 1.5H:1V (horizontal: vertical). This guideline assumes that all surface loads are kept at a minimum distance of at least one-half the depth of the cut away from the top of the slope, and that significant seepage is not present on the slope face. Flatter cut slopes will be necessary where significant seepage occurs or if large voids are created during excavation. Some sloughing and raveling of cut slopes should be expected. Temporary covering with heavy plastic sheeting should be used to protect slopes during periods of wet weather.

We anticipate that if perched groundwater is encountered during construction can be handled adequately with sumps, pumps, and/or diversion ditches. Groundwater handling needs will generally be lower during the late summer and early fall months. We recommend that the contractor performing the work be made responsible for controlling and collecting groundwater encountered during construction.

Permanent Slopes

We do not anticipate that permanent slopes will be utilized for the proposed project. If permanent slopes are necessary, we recommend the slopes be constructed at a maximum inclination of 2H:1V.

Where 2H:1V permanent slopes are not feasible, protective facings and/or retaining structures should be considered.

To achieve uniform compaction, we recommend that fill slopes be overbuilt and subsequently cut back to expose well-compacted fill. Fill placement on slopes should be benched into the slope face and include keyways. The configuration of the bench and keyway depends on the equipment being used. Bench excavations should be level and extend into the slope face. We recommend that a vertical cut of about 3 feet be maintained for benched excavations. Keyways should be about 1-1/2 times the width of the equipment used for grading or compaction.

Erosion Control

We anticipate that erosion control measures such as silt fences, straw bales and sand bags will generally be adequate during development. Temporary erosion control should be provided during construction activities and until permanent erosion control measures are functional. Surface water runoff should be properly contained and channeled using drainage ditches, berms, swales, and tightlines, and should not discharge onto sloped areas. Any disturbed sloped areas should be protected with a temporary covering until new vegetation can take effect. Jute or coconut fiber matting, excelsior matting or clear plastic sheeting is suitable for this purpose. Graded or disturbed slopes should be tracked in-place with the equipment running perpendicular to the slope contours so that the track marks provide a texture to help resist erosion. Ultimately, erosion control measures should be in accordance with local regulations and should be clearly described on project plans.

Wet Weather Earthwork

Some of the near surface soils contain up to about 25 percent fines. When the moisture content of the soil is more than a few percent above the optimum moisture content, the soil will become unstable and it will be difficult or impossible to meet the required compaction criteria. Disturbance of near surface soils should be expected if earthwork is completed during periods of wet weather.

The wet weather season in this area generally begins in October and continues through May. However, periods of wet weather may occur during any month of the year. If wet weather earthwork is unavoidable, we recommend that:

- The ground surface is sloped so that surface water is collected and directed away from the work area to an approved collection/dispersion point.
- Earthwork activities not take place during periods of heavy precipitation.
- Slopes with exposed soil be covered with plastic sheeting or otherwise protected from erosion.
- Measures are taken to prevent on-site soil and soil stockpiles from becoming wet or unstable. Sealing the surficial soil by rolling with a smooth-drum roller prior to periods of precipitation should reduce the extent that the soil becomes wet or unstable.
- Construction traffic is restricted to specific areas of the site, preferably areas that are surfaced with materials not susceptible to wet weather disturbance.
- A minimum 1-foot thick layer of 4- to 6-inch quarry spalls is used in high traffic areas of the site to protect the subgrade soil from disturbance.

- Contingencies are included in the project schedule and budget to allow for the above elements.

Structural Fill Materials

General

Material used for structural fill should be free of debris, organic material and rock fragments larger than 3 inches. The workability of material for use as structural fill will depend on the gradation and moisture content of the soil. As the amount of fines increases, soil becomes increasingly more sensitive to small changes in moisture content and adequate compaction becomes more difficult or impossible to achieve.

On-Site Soil

We anticipate that the majority of the on-site soils encountered during construction of the tank will consist of the gravels with sand and silt and the silty sands encountered in the upper portion of the explorations. It is our opinion that the silty sand material is not a suitable source for structural fill for use below structural elements, but may be used as backfill during a limited portion of the year. However, we anticipate that thin lifts (6-inches thick or less) will likely be needed to obtain compaction specifications. On-site materials used as backfill should be free of roots, organic matter and other deleterious materials and particles larger than 3 inches in diameter.

Select Granular Fill

Select granular fill should consist of imported, well-graded sand and gravel or crushed rock with a maximum particle size of 3 inches and less than 5 percent passing a U.S. Standard No. 200 sieve based on the minus ¾-inch fraction. Organic matter, debris or other deleterious material should not be present. In our experience, "gravel borrow" as described in Section 9-03.14(1) of the 2020 WSDOT Standard Specifications is typically a suitable source for select granular fill during periods of wet weather, provided that the percent passing a U.S. Standard No. 200 sieve is less than 5 percent based on the minus ¾-inch fraction.

Structural Fill Placement and Compaction

General

Structural fill should be placed on an approved subgrade that consists of uniformly firm and unyielding inorganic native soils or compacted structural fill. Structural fill should be compacted at a moisture content near optimum. The optimum moisture content varies with the soil gradation and should be evaluated during construction.

Structural fill should be placed in uniform, horizontal lifts and uniformly densified with vibratory compaction equipment. The maximum lift thickness will vary depending on the material and compaction equipment used but should generally not exceed the loose thicknesses provided on Table 2. Structural fill materials should be compacted in accordance with the compaction criteria provided in Table 3.

Table 2. Recommended Uncompacted Lift Thickness

Compaction Equipment	Recommended Uncompacted Lift Thickness (inches)	
	Granular Materials Maximum Particle Size $\leq 1\frac{1}{2}$ inch	Granular Materials Maximum Particle Size $> 1\frac{1}{2}$ inch
Hand Tools (Plate Compactors and Jumping Jacks)	4 – 8	Not Recommended
Rubber-tire Equipment	10 – 12	6 – 8
Light Roller	10 – 12	8 – 10
Heavy Roller	12 – 18	12 – 16
Hoe Pack Equipment	18 – 24	12 – 16

Note: The above table is intended to serve as a guideline and should not be included in the project specifications

Table 3. Recommended Compaction Criteria in Structural Fill Zones

Fill Type	Percent Maximum Dry Density Determined by ASTM Test Method D 1557 at $\pm 3\%$ of Optimum Moisture		
	0 to 2 Feet Below Subgrade	> 2 Feet Below Subgrade	Pipe Zone
Imported or On-site Granular, Maximum Particle Size $< 1\frac{1}{4}$ -inch	95	95	-----
Imported or On-site Granular, Maximum Particle Size $> 1\frac{1}{4}$ -inch	N/A (Proof-roll)	N/A (Proof-roll)	-----
Trench Backfill ¹	95	92	90

Note: ¹Trench backfill above the pipe zone in nonstructural areas should be compacted to at least 85 percent

Shallow Foundation Support

General

We recommend that the proposed structure be founded on a mat foundation or other footing appropriately designed by a structural engineer bearing on the underlying glacial till or bearing on a minimum 1-foot thick overexcavation to the glacial till horizon and replacement with compacted structural fill. The structural fill zone should extend to a horizontal distance equal to the overexcavation depth on each side of the footing. The actual overexcavation depth will vary, depending on the conditions encountered.

We recommend that an experienced geotechnical owner-representative observe the foundation surfaces before overexcavation, and before placing structural fill in overexcavations. This representative should confirm that adequate bearing surfaces have been prepared and that the soil conditions are as anticipated. Unsuitable foundation bearing soils should be recompacted or removed and replaced with compacted structural fill, as recommended by the geotechnical engineer.

Bearing Capacity

We recommend an allowable soil bearing pressure of 4,000 psf for reinforced mat foundations that are supported as recommended. This allowable bearing pressure applies to long-term dead and live loads exclusive of the weight of the footing and any overlying backfill. The allowable soil bearing pressure can be increased by one-third when considering total loads, including transient loads such as those induced by wind and seismic forces.

Settlement

We estimate that total settlement of footings that are designed and constructed as recommended should be less than 1 inch. We estimate that differential settlements should be ½ inch or less between comparably loaded isolated footings or along 50 feet of continuous footing. We anticipate that the settlement will occur essentially as loads are applied during construction.

Lateral Load Resistance

Lateral loads on shallow foundation elements may be resisted by passive resistance on the sides of footings and by friction on the base of footings. Passive resistance may be estimated using an equivalent fluid density of 330 pounds per cubic foot (pcf), assuming that the footings are backfilled with structural fill. Frictional resistance may be estimated using 0.4 for the coefficient of base friction of founded on the undisturbed very dense glacial till.

The lateral resistance values provided above incorporate a factor of safety of 1.5. The passive earth pressure and friction components can be combined, provided that the passive component does not exceed two-thirds of the total. The top foot of soil should be neglected when calculating passive resistance, unless the foundation perimeter area is covered by a slab-on-grade or pavement.

Slabs-On-Grade

Slabs-on-grade should be established on a minimum 1-foot thick section of structural fill extending to an approved bearing surface. A modulus of vertical subgrade reaction (subgrade modulus) can be used to design slabs-on-grade. The subgrade modulus varies based on the dimensions of the slab and the magnitude of applied loads on the slab surface; slabs with larger dimensions and loads are influenced by soils to a greater depth. We recommend a modulus value of 300 pounds per cubic inch (pci) for design of on-grade floor slabs with floor loads up to 500 psf. We are available to provide alternate subgrade modulus recommendations during design, based on specific loading information.

We recommend that slabs-on-grade in interior spaces be underlain by a minimum 4-inch thick capillary break layer to reduce the potential for moisture migration into the slab. The capillary break material should consist of a well-graded sand and gravel or crushed rock containing less than 5 percent fines based on the fraction passing the ¾-inch sieve. The 4-inch thick capillary break layer can be included when calculating the minimum 1-foot thick structural fill section beneath the slab.

If dry slabs are required (e.g., where adhesives are used to anchor carpet or tile to the slab), a waterproofing liner should be placed below the slab to act as a vapor barrier.

Subsurface Drainage

It is our opinion that foundation footing drains are likely necessary for the proposed structure. The site soils are underlain by shallow glacial till which are generally poorly draining. Footing drains should be routed to existing on-site or planned storm drainage.

Conventional Retaining Walls

General

The following sections provide general guidelines for retaining wall design on this site. We should be contacted during the design phase to review retaining wall plans and provide supplemental recommendations, if needed.

Drainage

Positive drainage is imperative behind any retaining structure. This can be accomplished by using a zone of free-draining material behind the wall with perforated pipes to collect water seepage. The drainage material should consist of coarse sand and gravel containing less than 5 percent fines based on the fraction of material passing the 3/4-inch sieve. The wall drainage zone should extend horizontally at least 12 inches from the back of the wall. If a stacked block wall is constructed, we recommend that a barrier such as a non-woven geotextile filter fabric be placed against the back of the wall to prevent loss of the drainage material through the wall joints.

A perforated smooth-walled rigid PVC pipe, having a minimum diameter of 4 inches, should be placed at the bottom of the drainage zone along the entire length of the wall. Drainpipes should discharge to a tightline leading to an appropriate collection and disposal system. An adequate number of cleanouts should be incorporated into the design of the drains in order to provide access for regular maintenance. Roof downspouts, perimeter drains or other types of drainage systems should not be connected to retaining wall drain systems.

Design Parameters

We recommend an active lateral earth pressure (K_a) of 28.8 psf (equivalent fluid density) for a level backfill condition. This assumes that the top of the wall is not structurally restrained and is free to rotate. For restrained walls that are fixed against rotation (at-rest condition), an equivalent fluid density of 55 pcf can be used for the level backfill condition. For seismic conditions, we recommend a uniform lateral pressure of $14H$ psf (where H is the height of the wall) be added to the lateral pressures. This seismic pressure assumes a peak ground acceleration of 0.32 g. Note that if the retaining system is designed as a braced system but is expected to yield a small amount during a seismic event, the active earth pressure condition may be assumed and combined with the seismic surcharge. Passive earth pressure (K_p) of 135 psf may be used if the wall is founded in the upper silty sand material. This value may be increased to 203 psf if the wall is founded 1 foot or more into the dense, glacial till.

The recommended earth pressure values do not include the effects of surcharges from surface loads or structures. If vehicles will be operated within one-half the height of the wall, a traffic surcharge should be added to the wall pressure. The traffic surcharge can be approximated by the equivalent

weight of an additional 2 feet of backfill behind the wall. Other surcharge loads, such as construction equipment, staging areas and stockpiled fill, should be considered on a case-by-case basis.

DOCUMENT REVIEW AND CONSTRUCTION OBSERVATION

We recommend that we be retained to review the portions of the plans and specifications that pertain to earthwork construction. We recommend that monitoring, testing and consultation be performed during construction to confirm that the conditions encountered are consistent with our explorations and our stated design assumptions. Insight Geologic would be pleased to provide these services upon request.

REFERENCES

International Code Council, "International Building Code", 2018.

Seismic Compression of As-compacted Fill Soils with Variable Levels of Fines Content and Fines Plasticity, Department of Civil and Environmental Engineering, University of California, Los Angeles, July 2004.

Washington State Department of Transportation (WSDOT), Standard Specifications for Road, Bridge and Municipal Construction Manual, 2020.

LIMITATIONS

We have prepared this geotechnical evaluation services report for the exclusive use by Mason County PUD 1 and their authorized agents for the proposed water tank project located on the northwest portion of Mason County parcel no. 32105-76-90011 in Mason County, Washington.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the field of geotechnical engineering in this area at the time this report was prepared. No warranty or other conditions, expressed or implied, should be understood.

Please refer to Attachment D titled "Report Limitations and Guidelines for Use" for additional information pertaining to use of this report.



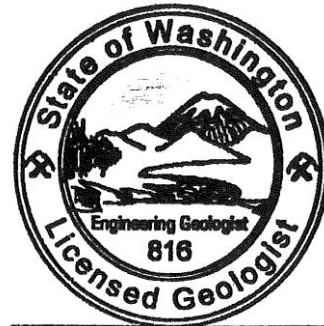
We appreciate the opportunity to be of service to you on this project. Please contact us if you have questions or require additional information.

Mason County PUD 1
Geotechnical Report
July 21, 2021

Respectfully Submitted,
INSIGHT GEOLOGIC, INC.



William E. Halbert, L.E.G., L.HG.
Principal



William E. Halbert

Attachments

FIGURES





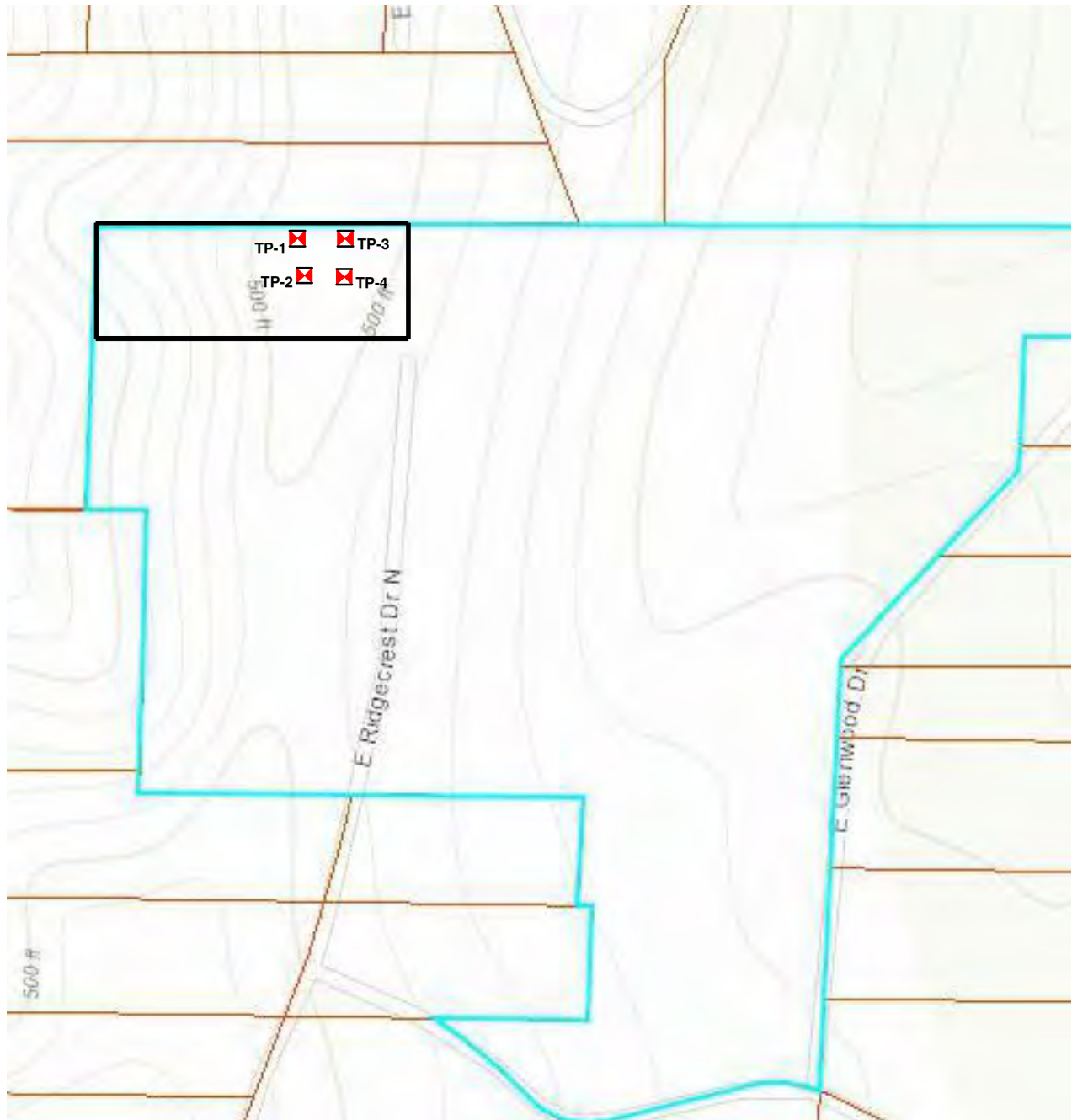
UNION, WASHINGTON
7.5 MINUTE QUADRANGLE
Year 2020

MASON COUNTY PUD #1 WATER TANK

MASON COUNTY, WASHINGTON



Figure 1
Vicinity Map



SOURCE: Mason County GIS

LEGEND:	
TP-1	APPROXIMATE TEST PIT LOCATION
	APPROXIMATE PROJECT BOUNDARY

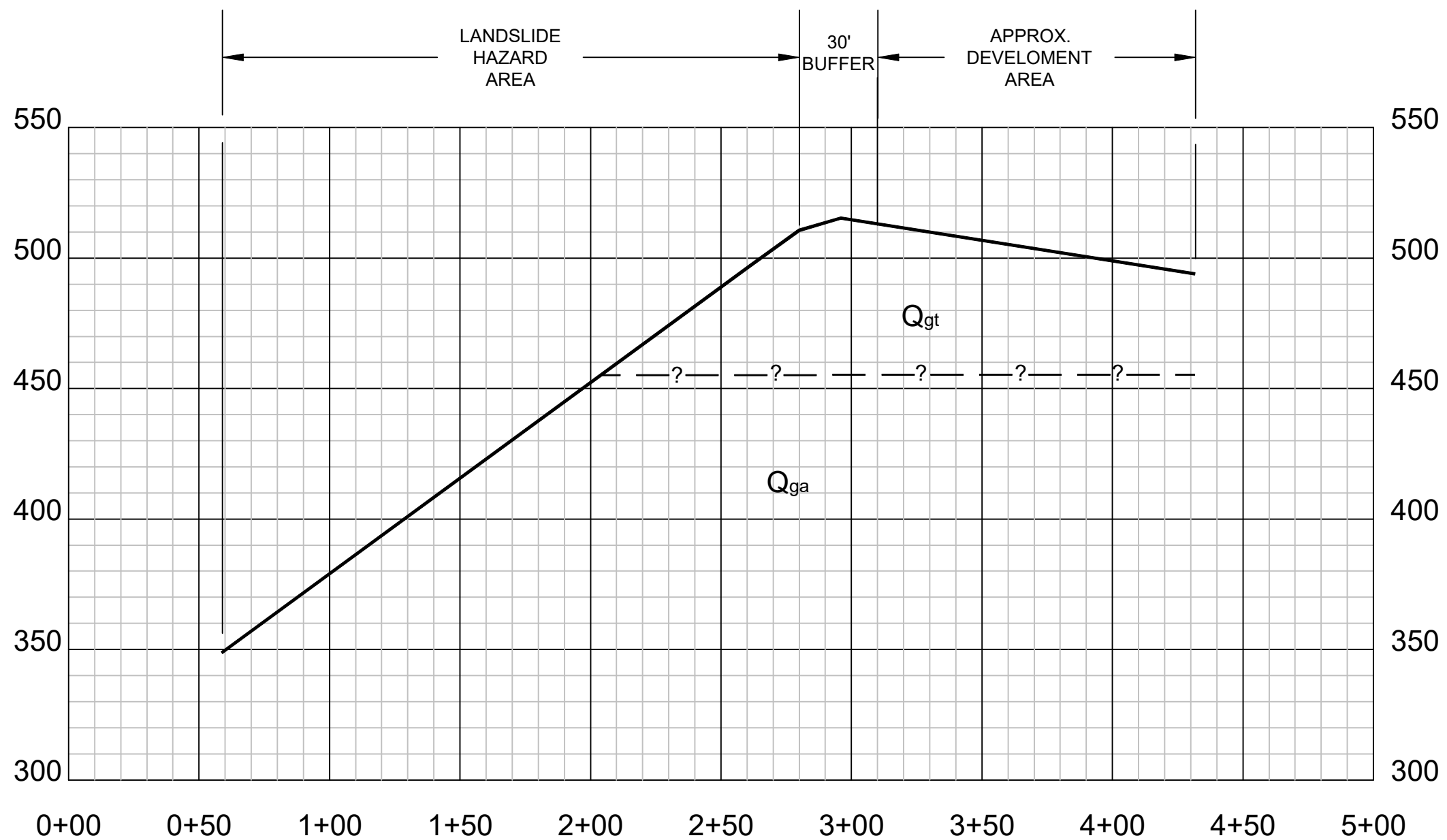
(1" = 200-FT)

MASON COUNTY PUD #1 WATER TANK

MASON COUNTY, WASHINGTON

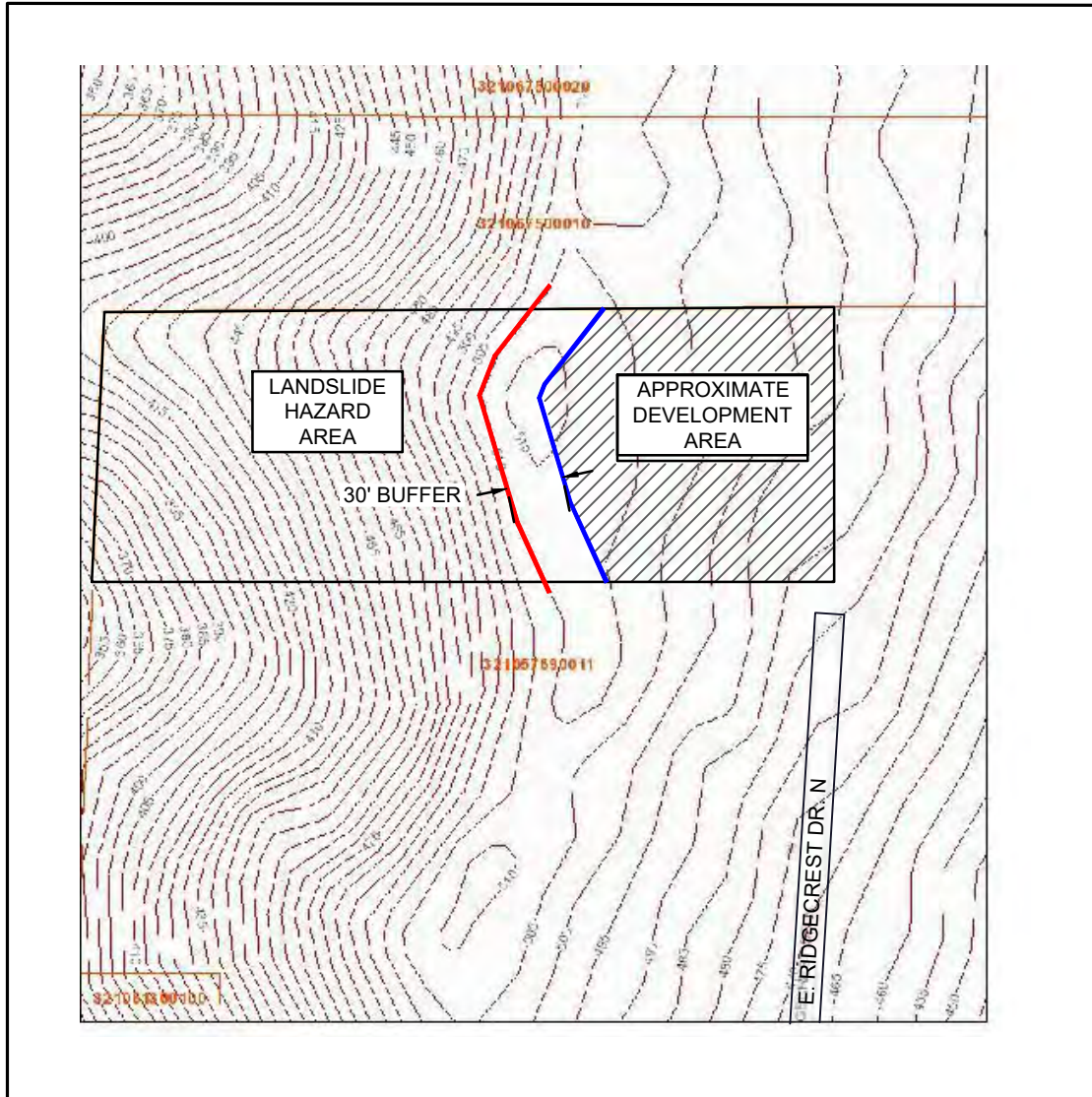


Figure 2
Site Plan



SECTION
 HORZ: 1" = 50-FT
 VERT: 1" = 50-FT

**MASON COUNTY PUD #1
 WATER TANK**
 MASON COUNTY, WASHINGTON



SOURCE: Mason County GIS


















MASON COUNTY PUD #1 WATER TANK

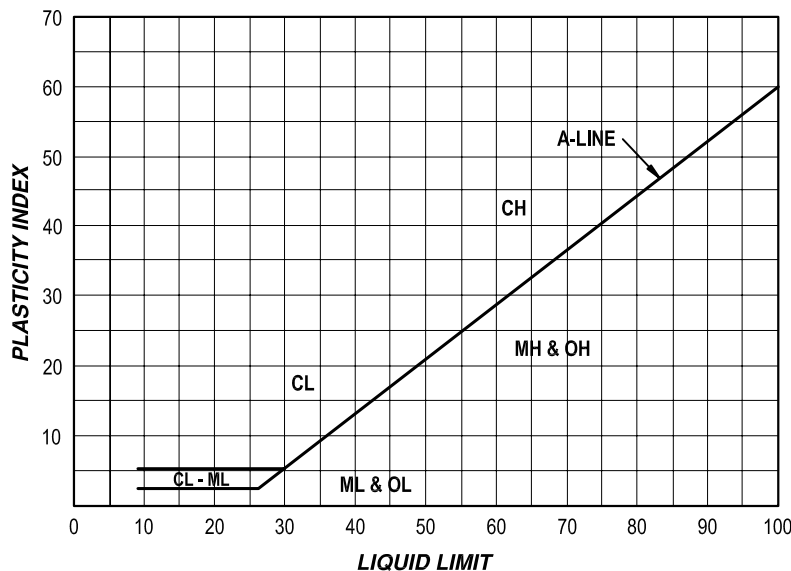
MASON COUNTY, WASHINGTON

ATTACHMENT A
EXPLORATION LOGS



SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		GROUP NAME
COARSE GRAINED SOILS MORE THAN 50% RETAINED ON NO. 200 SIEVE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVEL <5% FINES		GW	WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL
				GP	POORLY GRADED GRAVEL
		GRAVEL WITH FINES >12% FINES		GM	SILTY GRAVEL
				GC	CLAYEY GRAVEL
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	CLEAN SAND <5% FINES		SW	WELL-GRADED SAND, FINE TO COARSE SAND
				SP	POORLY GRADED SAND
		SAND WITH FINES >12% FINES		SM	SILTY SAND
				SC	CLAYEY SAND
FINE GRAINED SOILS MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50	INORGANIC		ML	SILT
				CL	CLAY
		ORGANIC		OL	ORGANIC SILT, ORGANIC CLAY
	SILTS AND CLAYS LIQUID LIMIT 50 OR MORE	INORGANIC		MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
				CH	CLAY OF HIGH PLASTICITY, FAT CLAY
		ORGANIC		OH	ORGANIC CLAY, ORGANIC SILT
		HIGHLY ORGANIC SOILS			PT



SOIL MOISTURE MODIFIERS:

DRY - ABSENCE OF MOISTURE, DUSTY, DRY TO THE TOUCH

MOIST - DAMP, BUT NO VISIBLE WATER

WET - VISIBLE FREE WATER OR SATURATED, USUALLY SOIL IS OBTAINED BELOW WATER TABLE

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS	TYPICAL DESCRIPTION	
	CC	CEMENT CONCRETE
	AC	ASPHALT CONCRETE
	CR	CRUSHED ROCK / QUARRY SPALLS
	TS	TOPSOIL/SOD/DUFF

GROUNDWATER EXPLORATION SYMBOLS

- MEASURED GROUNDWATER LEVEL IN EXPLORATION, WELL, OR PIEZOMETER
- GROUNDWATER OBSERVED AT TIME OF EXPLORATION
- PERCHED WATER OBSERVED AT TIME OF EXPLORATION
- MEASURED FREE PRODUCT IN WELL OR PIEZOMETER

STRATIGRAPHIC CONTACT

- APPROXIMATE CONTACT BETWEEN SOIL STRATA OR GEOLOGIC UNIT
- APPROXIMATE LOCATION OF SOIL STRATA CHANGE WITHIN GEOLOGIC SOIL UNIT
- APPROXIMATE GRADUAL CHANGE BETWEEN SOIL STRATA OR GEOLOGIC SOIL UNIT
- APPROXIMATE GRADUAL CHANGE OF SOIL STRATA WITHIN GEOLOGIC SOIL UNIT

LABORATORY / FIELD TEST CLASSIFICATIONS

- %F** PERCENT FINES
- AL** ATTERBERG LIMITS
- CA** CHEMICAL ANALYSIS
- CP** LABORATORY COMPACTION TEST
- CS** CONSOLIDATION TEST
- DS** DIRECT SHEAR
- HA** HYDROMETER ANALYSIS
- MC** MOISTURE CONTENT
- MD** MOISTURE CONTENT AND DRY DENSITY
- OC** ORGANIC COMPOUND
- PM** PERMEABILITY OR HYDRAULIC CONDUCTIVITY
- PP** POCKET PENETROMETER
- SA** SIEVE ANALYSIS
- TX** TRIAXIAL COMPRESSION
- UC** UNCONFINED COMPRESSION
- VS** VANE SHEAR

SAMPLER SYMBOLS

- 2.4 INCH I.D. SPLIT BARREL
- DIRECT-PUSH
- STANDARD PENETRATION TEST
- SHELBY TUBE
- PISTON
- BULK OR GRAB

SHEEN CLASSIFICATIONS

- NS** NO VISIBLE SHEEN
- SS** SLIGHT SHEEN
- MS** MODERATE SHEEN
- HS** HEAVY SHEEN
- NT** NOT TESTED



PROJECT: Mason County PUD 1 Water Tank
 PROJECT NO.: 1171-002-01
 LOCATION: Mason County, Washington

TP-1

DATE: 6/16/2021

TOTAL DEPTH: 1

DEPTH (FT)	U.S.C.S.	LITHOLOGY	SOIL DESCRIPTION	REMARKS AND OTHER TESTS
------------	----------	-----------	------------------	-------------------------

0	GP-GM P-SM		Sand and Silt: Brown, fine to medium sand with silt and fine to coarse gravel, moist, medium dense	Test pit completed at 1 foot bgs after encountering glacial till
1	GP-GM		GM: Light brown, fine to coarse gravel with silt and fine to coarse sand and cobbles, moist, very dense	
2				
3				
4				
5				
6				
7				
8				
9				
10				



Operator: Neal Graham
 Equipment: Yanmar 35C
 Logged By: Neal Graham


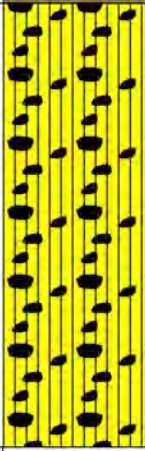
Figure A-2

PROJECT: Mason County PUD 1 Water Tank
 PROJECT NO.: 1171-002-01
 LOCATION: Mason County, Washington

TP-2

DATE: 6/16/2021

TOTAL DEPTH: 3.5

DEPTH (FT)	U.S.C.S.	LITHOLOGY	SOIL DESCRIPTION	REMARKS AND OTHER TESTS
0	Duff		: Forest Duff	
1	GW-GM		GW-GM: Red brown, fine to coarse gravel with silt and fine to coarse sand, moist, medium dense	
2				
3			Grades to light brown with cobbles, dense	
4				Test pit completed at 3.5 feet bgs after encountering glacial till. No groundwater encountered.
5				
6				
7				
8				
9				
10				



Operator: Neal Graham
 Equipment: Yanmar 35C
 Logged By: Neal Graham


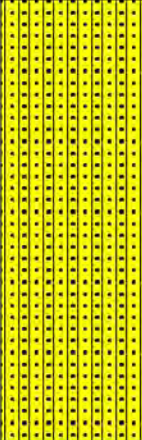

Figure A-3

PROJECT: Mason County PUD 1 Water Tank
 PROJECT NO.: 1171-002-01
 LOCATION: Mason County, Washington

TP-3

DATE: 6/16/2021

TOTAL DEPTH: 3.5

DEPTH (FT)	U.S.C.S.	LITHOLOGY	SOIL DESCRIPTION	REMARKS AND OTHER TESTS
0	Duff		: Forest Duff	Test pit completed at 3.5 feet bgs after encountering glacial till. No groundwater encountered.
1	SM		SM: Red brown, silty fine to coarse sand and fine to coarse gravel, moist, medium dense	
3			Grades to light brown with cobbles, dense	
4				
5				
6				
7				
8				
9				
10				



Operator: Neal Graham
 Equipment: Yanmar 35C
 Logged By: Neal Graham


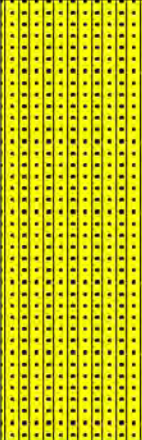

Figure A-4

PROJECT: Mason County PUD 1 Water Tank
 PROJECT NO.: 1171-002-01
 LOCATION: Mason County, Washington

TP-4

DATE: 6/16/2021

TOTAL DEPTH: 3.5

DEPTH (FT)	U.S.C.S.	LITHOLOGY	SOIL DESCRIPTION	REMARKS AND OTHER TESTS
0	Duff		: Forest Duff	Test pit completed at 3.5 feet bgs after encountering glacial till. No groundwater encountered.
1	SM		SM: Red brown, silty fine to coarse sand and fine to coarse gravel, moist, medium dense	
3			Grades to light brown with cobbles, dense	
4				
5				
6				
7				
8				
9				
10				



Operator: Neal Graham
 Equipment: Yanmar 35C
 Logged By: Neal Graham

Figure A-5

ATTACHMENT B
LABORATORY TEST RESULTS



Gradation Analysis Summary Data

Job Name: Mason County PUD1 Water Tank
Job Number: 1171-002-01
Date Tested: 6/24/21
Tested By: Neal Graham

Sample Location: TP-1
Sample Name: TP-1 0.5' - 1.0'
Depth: 0.5 - 1 Feet

Moisture Content (%) 6.7%

Sieve Size	Percent Passing	Size Fraction	Percent by Weight
3.0 in. (75.0)	100.0	Coarse Gravel	45.8
1.5 in. (37.5)	100.0	Fine Gravel	19.0
3/4 in. (19.0)	54.2		
3/8 in. (9.5-mm)	45.0	Coarse Sand	10.6
No. 4 (4.75-mm)	35.1	Medium Sand	9.6
No. 10 (2.00-mm)	24.5	Fine Sand	8.0
No. 20 (.850-mm)	18.4		
No. 40 (.425-mm)	14.9	Fines	6.9
No. 60 (.250-mm)	12.4	Total	100.0
No. 100 (.150-mm)	9.9		
No. 200 (.075-mm)	6.9		

LL --
PL --
PI --

D₁₀ 0.15
D₃₀ 3.10
D₆₀ 21.00
D₉₀ 32.00

Cc 3.05
Cu 140.00

ASTM Classification

Group Name: **Poorly Graded Gravel with Sand and Silt**

Symbol: **GP-GM**

Gradation Analysis Summary Data

Job Name: Mason County PUD1 Water Tank
Job Number: 1171-002-01
Date Tested: 6/24/21
Tested By: Neal Graham

Sample Location: TP-2
Sample Name: TP-2 0.5' - 3.0'
Depth: 0.5 - 3 Feet

Moisture Content (%) 8.8%

Sieve Size	Percent Passing	Size Fraction	Percent by Weight
3.0 in. (75.0)	100.0	Coarse Gravel	38.6
1.5 in. (37.5)	100.0	Fine Gravel	17.9
3/4 in. (19.0)	61.4		
3/8 in. (9.5-mm)	56.7	Coarse Sand	10.8
No. 4 (4.75-mm)	43.5	Medium Sand	9.7
No. 10 (2.00-mm)	32.8	Fine Sand	14.0
No. 20 (.850-mm)	27.0		
No. 40 (.425-mm)	23.0	Fines	9.0
No. 60 (.250-mm)	19.2	Total	100.0
No. 100 (.150-mm)	14.7		
No. 200 (.075-mm)	9.0		

LL --
PL --
PI --

D₁₀ 0.09
D₃₀ 1.50
D₆₀ 18.00
D₉₀ 30.00

Cc 1.47
Cu 211.76

ASTM Classification
Group Name: **Well Graded Gravel with Sand and Silt**
Symbol: **GP-GM**

Gradation Analysis Summary Data

Job Name: Mason County PUD1 Water Tank
Job Number: 1171-002-01
Date Tested: 6/24/21
Tested By: Neal Graham

Sample Location: TP-3
Sample Name: TP-3 0.5' - 3.0'
Depth: 0.5 - 3 Feet

Moisture Content (%) 15.6%

Sieve Size	Percent Passing	Size Fraction	Percent by Weight
3.0 in. (75.0)	100.0	Coarse Gravel	12.7
1.5 in. (37.5)	100.0	Fine Gravel	29.6
3/4 in. (19.0)	87.3		
3/8 in. (9.5-mm)	68.3	Coarse Sand	13.1
No. 4 (4.75-mm)	57.7	Medium Sand	12.4
No. 10 (2.00-mm)	44.6	Fine Sand	18.2
No. 20 (.850-mm)	36.9		
No. 40 (.425-mm)	32.1	Fines	14.0
No. 60 (.250-mm)	27.0	Total	100.0
No. 100 (.150-mm)	21.0		
No. 200 (.075-mm)	14.0		

LL --
PL --
PI --

D₁₀ 0.00
D₃₀ 0.33
D₆₀ 5.60
D₉₀ 21.00

Cc --
Cu --

ASTM Classification
Group Name: **Silty Sand with Gravel**
Symbol: **SM**

Gradation Analysis Summary Data

Job Name: Mason County PUD1 Water Tank
Job Number: 1171-002-01
Date Tested: 6/24/21
Tested By: Neal Graham

Sample Location: TP-4
Sample Name: TP-4 3.0' - 3.5'
Depth: 3 - 3.5 Feet

Moisture Content (%) 9.2%

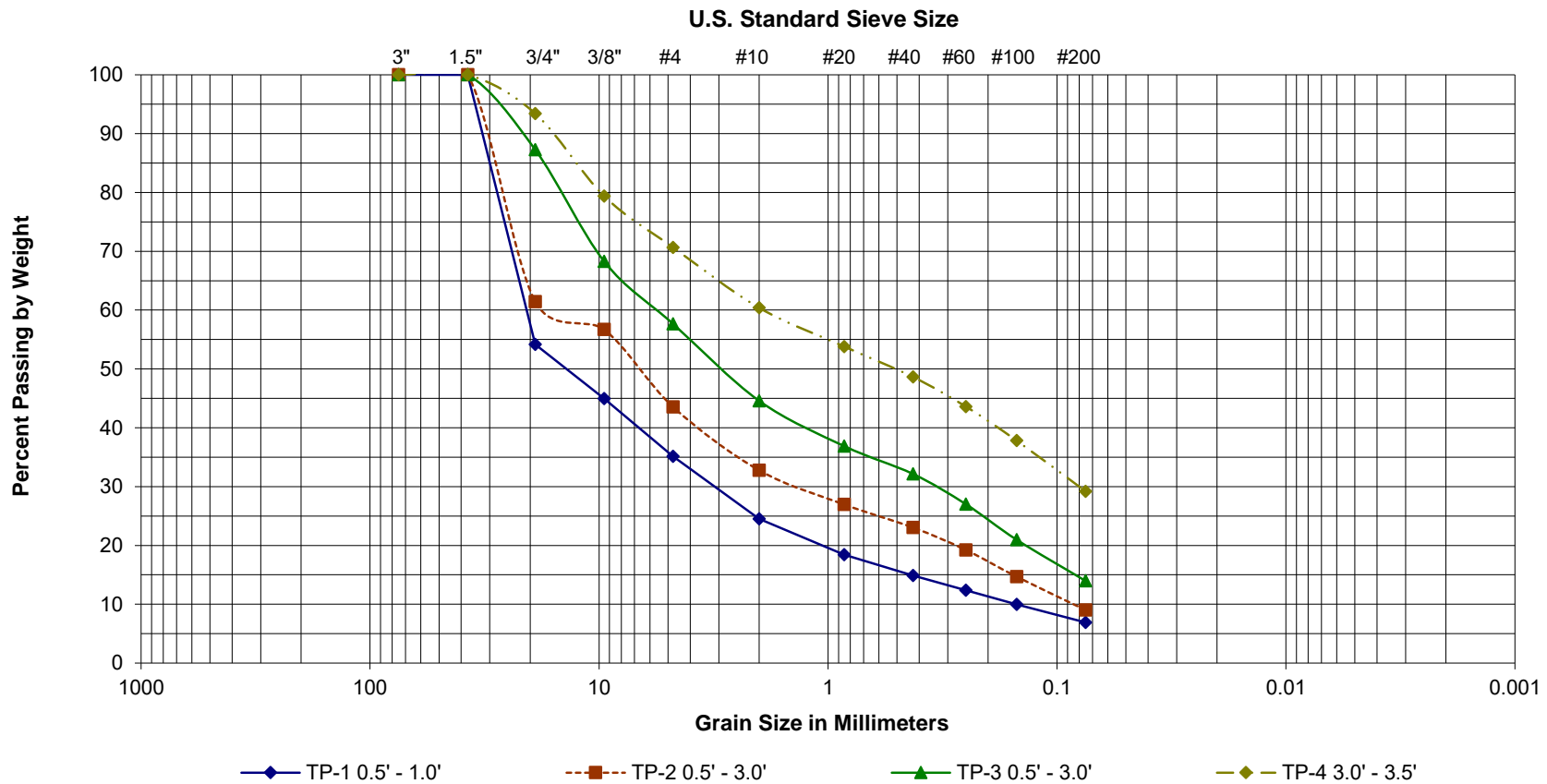
Sieve Size	Percent Passing	Size Fraction	Percent by Weight
3.0 in. (75.0)	100.0	Coarse Gravel	6.6
1.5 in. (37.5)	100.0	Fine Gravel	22.8
3/4 in. (19.0)	93.4		
3/8 in. (9.5-mm)	79.4	Coarse Sand	10.3
No. 4 (4.75-mm)	70.7	Medium Sand	11.8
No. 10 (2.00-mm)	60.4	Fine Sand	19.4
No. 20 (.850-mm)	53.8		
No. 40 (.425-mm)	48.6	Fines	29.2
No. 60 (.250-mm)	43.6	Total	100.0
No. 100 (.150-mm)	37.8		
No. 200 (.075-mm)	29.2		

LL --
PL --
PI --

D₁₀ 0.00
D₃₀ 0.08
D₆₀ 1.90
D₉₀ 16.00

Cc --
Cu --

ASTM Classification
Group Name: **Silty Sand with Gravel**
Symbol: **SM**



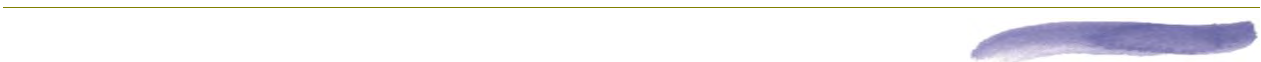
MASON COUNTY PUD 1 WATER TANK

MASON COUNTY, WASHINGTON



Graph 1
Gratation Analysis Results

ATTACHMENT C
MASON COUNTY COMMUNITY SERVICES
SUBMITTAL CHECKLIST GEOTEHCNICAL REPORT





MASON COUNTY COMMUNITY SERVICES

Building, Planning, Environmental Health, Community Health

Submittal Checklist Geotechnical Report

Instructions:

This checklist must be submitted with a Geotechnical Report and completed, signed, and stamped by the licensed professional(s) who prepared the Geotechnical Report for review by Mason County pursuant to the Mason County Resource Ordinance. If an item is found not applicable, the report should explain the basis for the conclusion.

Note: Unless specifically documented, this report does not provide compliance to the International Residential Code Sections R403.1.7 for foundations on or adjacent to slopes, Section R403.1.8 for expansive soils or section 1808.7.1 of the International Building Code Section for Foundations on or adjacent to slopes.

Applicant/Owner Mason County PUD 1 Parcel # Lot A1 of Parcel #32105-76-90011

Site Address N/A

- (1) (a) A discussion of general geologic conditions in the vicinity of the proposed development,
Located on page(s) 3
- (b) A discussion of specific soil types,
Located on page(s) 3
- (c) A discussion of ground water conditions,
Located on page(s) 4
- (d) A discussion of the upslope geomorphology,
Located on page(s) 2-3
- (e) A discussion of the location of upland waterbodies and wetlands,
Located on page(s) 3
- (f) A discussion of history of landslide activity in the vicinity, as available in the referenced maps and records.
Located on page(s) 3
- (2) A site plan which identifies the important development and geologic features.
Located on Map(s) Figures 3,4
- (3) Locations and logs of exploratory holes or probes.
Located on Map(s) Figure 2
- (4) The area of the proposed development, the boundaries of the hazard, and associated buffers and setbacks shall be delineated (top, both sides, and toe) on a geologic map of the site.
Located on Map(s) Figure 3,4
- (5) A minimum of one cross section at a scale which adequately depicts the subsurface profile, and which incorporates the details of proposed grade changes.
Located on Map(s) Figure 3
- (6) A description and results of slope stability analyses performed for both static and seismic loading conditions. Analysis should examine worst case failures. The analysis should include the Simplified Bishop's Method of Circles. The minimum static safety factor is 1.5, the minimum seismic safety factor is 1.1, and the quasi-static analysis coefficients should be a value of 0.15.
Located on page(s) N/A Seismic Discussion page 4 and 5
- (7) (a) Appropriate restrictions on placement of drainage features,

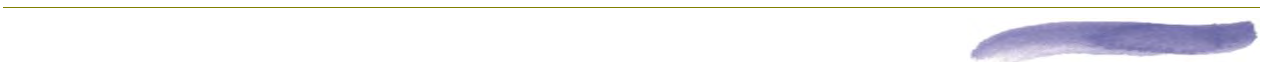
- Located on page(s) 8, 12
- (b) Appropriate restrictions on placement of septic drain fields,
Located on page(s) N/A
- (c) Appropriate restrictions on placement of compacted fills and footings,
Located on page(s) N/A
- (d) Recommended buffers from the landslide hazard areas shoreline bluffs and the tops of other slopes.
Located on page(s) 6
- (e) Recommended setbacks from the landslide hazard areas shoreline bluffs and the tops of other slopes.
Located on page(s) 6
- (8) Recommendations for the preparation of a detailed clearing and grading plan which specifically identifies vegetation to be removed, a schedule for vegetation removal and replanting, and the method of vegetation removal.
Located on page(s) 6,7
- (9) Recommendations for the preparation of a detailed temporary erosion control plan which identifies the specific mitigating measures to be implemented during construction to protect the slope from erosion, landslides and harmful construction methods.
Located on page(s) 8
- (10) An analysis of both on-site and off-site impacts of the proposed development.
Located on page(s) 6
- (11) Specifications of final development conditions such as, vegetative management, drainage, erosion control, and buffer widths.
Located on page(s) 6-8
- (12) Recommendations for the preparation of structural mitigation or details of other proposed mitigation.
Located on page(s) 5
- (13) A site map drawn to scale showing the property boundaries, scale, north arrow, and the location and nature of existing and proposed development on the site.
Located on Map(s) Figure 4

I, William E. Halbert hereby certify under penalty of perjury that I am a civil engineer licensed in the State of Washington with specialized knowledge of geotechnical/geological engineering or a geologist or engineering geologist licensed in the State of Washington with special knowledge of the local conditions. I also certify that the



Geotechnical Report, dated July 21, 2021, and entitled Geotechnical Assessment Report, Mason County PUD 1, July 21, 2021 meets all the requirements of the Mason County Resource Ordinance, Geologically Hazardous Areas Section, is complete and true, that the assessment demonstrates conclusively that the risks posed by the landslide hazard can be mitigated through the included geotechnical design recommendations, and that all hazards are mitigated in such a manner as to prevent harm to property and public health and safety.

ATTACHMENT D
REPORT LIMITATIONS AND GUIDELINES FOR USE



ATTACHMENT D

REPORT LIMITATIONS AND GUIDELINES FOR USE¹

This attachment provides information to help you manage your risks with respect to the use of this report.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES, PERSONS AND PROJECTS

This report has been prepared for the exclusive use by Mason County PUD 1 (Client) and their authorized agents. This report may be made available to regulatory agencies for review. This report is not intended for use by others, and the information contained herein is not applicable to other sites.

Insight Geologic Inc. structures our services to meet the specific needs of our clients. For example, a geotechnical or geologic study conducted for a civil engineer or architect may not fulfill the needs of a construction contractor or even another civil engineer or architect that are involved in the same project. Because each geotechnical or geologic study is unique, each geotechnical engineering or geologic report is unique, prepared solely for the specific client and project site. Our report is prepared for the exclusive use of our Client. No other party may rely on the product of our services unless we agree in advance to such reliance in writing. This is to provide our firm with reasonable protection against open-ended liability claims by third parties with whom there would otherwise be no contractual limits to their actions. Within the limitations of scope, schedule and budget, our services have been executed in accordance with our Agreement with the Client and generally accepted geotechnical practices in this area at the time this report was prepared. This report should not be applied for any purpose or project except the one originally contemplated.

A GEOTECHNICAL ENGINEERING OR GEOLOGIC REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

Insight Geologic, Inc. considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless Insight Geologic specifically indicates otherwise, do not rely on this report if it was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

For example, changes that can affect the applicability of this report include those that affect:

- the function of the proposed structure;
- elevation, configuration, location, orientation or weight of the proposed structure;
- composition of the design team; or
- project ownership.

¹ Developed based on material provided by ASFE, Professional Firms Practicing in the Geosciences; www.asfe.org.

If important changes are made after the date of this report, Insight Geologic should be given the opportunity to review our interpretations and recommendations and provide written modifications or confirmation, as appropriate.

SUBSURFACE CONDITIONS CAN CHANGE

This geotechnical or geologic report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by manmade events such as construction on or adjacent to the site, or by natural events such as floods, earthquakes, slope instability or ground water fluctuations. Always contact Insight Geologic before applying a report to determine if it remains applicable.

MOST GEOTECHNICAL AND GEOLOGIC FINDINGS ARE PROFESSIONAL OPINIONS

Our interpretations of subsurface conditions are based on field observations from widely spaced sampling locations at the site. Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Insight Geologic reviewed field and laboratory data and then applied our professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ, sometimes significantly, from those indicated in this report. Our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

GEOTECHNICAL ENGINEERING REPORT RECOMMENDATIONS ARE NOT FINAL

Do not over-rely on the preliminary construction recommendations included in this report. These recommendations are not final, because they were developed principally from Insight Geologic's professional judgment and opinion. Insight Geologic's recommendations can be finalized only by observing actual subsurface conditions revealed during construction. Insight Geologic cannot assume responsibility or liability for this report's recommendations if we do not perform construction observation.

Sufficient monitoring, testing and consultation by Insight Geologic should be provided during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated, and to evaluate whether or not earthwork activities are completed in accordance with our recommendations. Retaining Insight Geologic for construction observation for this project is the most effective method of managing the risks associated with unanticipated conditions.

A GEOTECHNICAL ENGINEERING OR GEOLOGIC REPORT COULD BE SUBJECT TO MISINTERPRETATION

Misinterpretation of this report by other design team members can result in costly problems. You could lower that risk by having Insight Geologic confer with appropriate members of the design team after submitting the report. Also retain Insight Geologic to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering or geologic report. Reduce that risk by having Insight Geologic participate in pre-bid and pre-construction conferences, and by providing construction observation.

DO NOT REDRAW THE EXPLORATION LOGS

Geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering or geologic report should never be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, but recognize that separating logs from the report can elevate risk.

GIVE CONTRACTORS A COMPLETE REPORT AND GUIDANCE

Some owners and design professionals believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering or geologic report, but preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with Insight Geologic and/or to conduct additional study to obtain the specific types of information they need or prefer. A pre-bid conference can also be valuable. Be sure contractors have sufficient time to perform additional study. Only then might an owner be in a position to give contractors the best information available, while requiring them to at least share the financial responsibilities stemming from unanticipated conditions. Further, a contingency for unanticipated conditions should be included in your project budget and schedule.

CONTRACTORS ARE RESPONSIBLE FOR SITE SAFETY ON THEIR OWN CONSTRUCTION PROJECTS

Our geotechnical recommendations are not intended to direct the contractor's procedures, methods, schedule or management of the work site. The contractor is solely responsible for job site safety and for managing construction operations to minimize risks to on-site personnel and to adjacent properties.

READ THESE PROVISIONS CLOSELY

Some clients, design professionals and contractors may not recognize that the geoscience practices (geotechnical engineering or geology) are far less exact than other engineering and natural science disciplines. This lack of understanding can create unrealistic expectations that could lead to disappointments, claims and disputes. Insight Geologic includes these explanatory "limitations" provisions in our reports to help reduce such risks. Please confer with Insight Geologic if you are unclear how these "Report Limitations and Guidelines for Use" apply to your project or site.

GEOTECHNICAL, GEOLOGIC AND ENVIRONMENTAL REPORTS SHOULD NOT BE INTERCHANGED

The equipment, techniques and personnel used to perform an environmental study differ significantly from those used to perform a geotechnical or geologic study and vice versa. For that reason, a geotechnical engineering or geologic report does not usually relate any environmental findings, conclusions or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Similarly, environmental reports are not used to address geotechnical or geologic concerns regarding a specific project.

APPENDIX D

PERMITS